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APPENDIX H.

TO

SECOND REPORT OF COMMITTEE

UPON

THE FEVER HOSPITAL

AND

MUNICIPAL IMPROVEMENTS:

CONTAINING

PAPERS (FORMING A CONTINUATION OF THOSE PRINTED IN APPENDIX TO APPENDIX G.)
SELECTED FROM THE RECORDS OF THE COMMITTEE APPOINTED TO CONTROL AND DIRECT THE EXECUTION OF LIEUTENANT J. A. SCHALCH'S PLAN OF A LINE OF CANAL FROM THE RIVER HOOGLY TO KOOLNA, TO ALLOW OF AN EASY AND PERMANENT COMMUNICATION BETWEEN THE UPPER AND EASTERN PROVINCES OF INDIA AND CALCUTTA BY WATER, THROUGH THE SOONDURBUN PASSAGAES, DURING THE DRY SEASON.

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CONTENTS

Editorial	1
Original papers	1-100
Review articles	101-150
Correspondence	151-200
Announcements	201-250

Subscription information

APPENDIX, (H)

Index.

Papers (forming a continuation of those printed in Appendix to Appendix G. selected from the Records of the Committee appointed to control and direct the execution of LIEUTENANT J. A. SCHALCH'S Plan of a line of Canal from the River Hoogly to Koolna, to allow of an easy and permanent communication between the Upper and Eastern Provinces of India and Calcutta by Water through the Soondurbun passages and Salt Water Lake during the Dry Season.

	PAGE.
No. 1. Letter from Mr. Secretary Mackenzie, dated 20th March 1823, to W. Paton, Esq. 2nd Member Board of Revenue L. P. H. Shakespear, Superintendent Police, C. R. Barwell, Magistrate Suburbs of Calcutta, and Captain W. Swinton, Superintendent Public Buildings L. P. appointing them a Committee to control and direct the execution of Lieutenant Schalch's Plan of a line of Canal from the River Hoogly to Koolna, and transmitting a Copy of a resolution passed by the Government this day. (For this resolution Vide Appendix to Appendix G. Paper marked F 1.)	Territorial Department, Revenue Consultation, No. 44. 20th March 1823.
No. 1 $\frac{1}{4}$. Letter from Secretary Board of Revenue, dated 14th February 1823, to Mr. Secretary Mackenzie, transmitting the Paper marked No. 1 $\frac{1}{4}$. a. and No. 1 $\frac{1}{4}$. a.(1)	Ibid, No. 4. 27th February 1823.
No. 1 $\frac{1}{4}$. a. Letter from the Collector of the 24-Purgunnahs, dated 28th January 1823, to the Secretary to the Board of Revenue, relative to the necessity of excavating the obstructed passages of the Balliaghatta Canal.	NOTE.—These Papers are not recorded in the Canal Committee's Proceedings. J. M.
No. 1 $\frac{1}{4}$. a.(1) Estimate of the expense of clearing the obstructed passages of the Balliaghatta Canal.	Territorial Department, Revenue Consultation, No. 5. 27th February 1823.
No. 1 $\frac{1}{2}$. Letter from Mr. Secretary Mackenzie, dated 27th February 1823, to Lieutenant Schalch, transmitting the above Papers marked No. 1 $\frac{1}{4}$. to No. 1 $\frac{1}{4}$. a.(1) inclusive, and requesting him to report on the expediency of clearing the above Canal.	
No. 2. Letter from Mr. Secretary Mackenzie, dated 10th April 1823, to Canal Committee, transmitting the Paper marked No. 2. a. and No. 2. b.	Ibid, No. 20. 10th April 1823.

Territorial Department, Revenue Consultation, No. 21, 10th April 1823.

No. 2. *a.* Letter from Lieutenant Schalch, dated 5th April 1823, to Mr. Secretary Mackenzie, in reply to his letter of the 27th February 1823, (marked No. 1½.) states that if the head of the Eastern or Balliaghatta Canal were under the influence of the Tides from the Soonderbuns, which it could be made to be by a bund, to prevent the Soonderbun Tide spreading over the Lake, of 4 feet by 8 feet broad from the head of the Balliaghatta Canal to Bahminghatta on the Eastern side of the Lake, a distance of 6 miles, which at 10 per 100 square feet, will come to Sa. Rs. 6,331, a considerable amount of the filth of the Town, which is now deposited in the Canal, would be carried into the deep Soonderbun passages of the Eastern Lake; and that from Balliaghatta end of Entallee Canal to 7,800 feet into the Lake is dry at low water, and only partially covered during the flood-tide, that beyond the above distance the Lake is deep and broad, and forms a passage for the Soonderbun Tide, and that if the bund above referred to, were made, it would probably raise the water in the Balliaghatta Canal about 3 feet.

Ibid, No. 22. 10th April 1823.

No. 2. *b.* Letter from Mr. Secretary Mackenzie, dated 23d April 1823, replying to Lieutenant Schalch's letter, (marked No. 2.(a)) authorizing the measures proposed by him.

Ibid, No. 12. 23rd April 1823.

No. 3. Letter from Secretary to Government, dated 23d April 1823, to the Members of the Canal Committee, transmitting the Paper marked H⁽¹⁾ printed in Appendix to Appendix G.

Canal Committee's Proceedings, Vol. 1, page 75.

No. 4. Letter dated 14th May 1823, from the Secretary to the Canal Committee to Superintendent of Canals, transmitting the Resolution of Government of the 23rd April 1823, relative to the Supplementary Report of the Special, or Lieutenant Schalch's Committee, on the construction of the Canal to Channel Creek and Diamond Harbour, and requesting his early attention to the 8th and 9th Paragraphs of the above Resolution.

Territorial Department, Revenue Consultation No. 10, 12th June 1823.

* This Minute Survey is possibly amongst the Original Proceedings of the Canal Department.—J. M.

No. 5. Letter from Superintendent of Canals, dated 15th May 1823, to Canal Committee, stating that he had completed a Minute* Survey of Tolly's Nullah, when he received the Resolution of Government of the 23rd April instant, which requires that Tolly's Nullah should be considered solely with reference to the Diamond Harbour and Saugor Canal, and requesting time to furnish a Report.—(See Letter of Government, dated 12th June 1823, marked, No. 10. and No. 11.)

Canal Committee's Proceedings, Vol. 1, page

No. 6. Further reply by Superintendent of Canals, dated 19th May 1823, to the Secretary to the Canal Committee's letter of the 14th May 1823, relative to Tolly's Nullah. &c.

- No. 7. Letter from Canal Committee, dated 27th May 1823, to Mr. Secretary Mackenzie, transmitting the Paper marked No. 5.—
(See Paper marked No. 10.)
- No. 8. Letter from Canal Committee, dated 10th June 1823, to Government, transmitting extracts from Superintendent of Canals' letter of the 19th May instant (Vide Paper marked No. 6.) with the opinion of the Canal Committee thereon. For answer to this Vide Paper marked No. 10.
- No. 9. Letter from Canal Committee, to Mr. Secretary Mackenzie, dated 10th June 1823, laying before the Government their intended Plan of procedure in respect to purchasing Land, &c. for the proposed Circular and Eastern Canals.—See Paper marked No. 12.
- No. 10. Letter from Mr. Secretary Mackenzie, dated 12th June 1823, in reply to Committee's letter of the 27th May instant, states that what is done to *Tolly's Nullah* must be done with *reference* to the *Saugor Canal*.—See Paper marked No. 5. ..
- No. 11. Letter from Secretary to Government, dated 12th June 1823, to Secretary to Canal Committee, stating that the Governor General in Council approves the suggestion that the *Saugor* and *Eastern Canal* should both be commenced on after the ensuing rainy season.
- No. 12. Letter from Secretary to Government, dated 19th June 1823, approving the Plan of Procedure proposed by the Committee.—See Paper marked No. 9.
- No. 13. Letter from the Secretary to the Canal Committee, dated 24th June, to Superintendent of Canals, requesting his sentiments on the subject of straightening the line of Canal between Bahminghatta and Chiltabariah.
- No. 14. Letter from the Acting Collector of Jessore, dated 24th July 1823, to Secretary to Canal Committee, transmitting the Paper marked, No. 14. a.
- No. 14. a. List of the Landholders, through whose Estates the proposed Canal to Koolna is to pass.
- No. 15. Letter from Superintendent of Canals, dated 25th July 1823, to Canal Committee in reply to their Letter of the 24th June 1823, marked No. 13. relative to straightening the line of Canal between Bahminghatta and Chiltabariah, states that the present passage from Tardah to the Salt Water Lake, which is extremely disagreeable, in consequence of its lying for the

Territorial Department, Revenue Consultation, No. 9. 12th June 1823.

Canal Committee's Proceedings, Vol. 1. page

Territorial Department, Revenue Consultation, No. 16. 19th June 1823.

Canal Committee's Proceedings, Vol. 1. page 107.

Territorial Department Revenue Consultation, No. 12. 12th June 1823.

Ibid, No. 17. 19th June 1823.

Canal Committee's Proceedings, Vol. 1. page 110.

Ibid, Vol. 1, page 152.

Ibid.

Territorial Department, Revenue Consultation, No. 37. 21st August 1823.

greater part, through Jungle, and from the strong currents which set down it from the Lake during the rains, will be avoided by the proposed alterations ; and describes the nature of the ground about Poorooh Dhappa and the Eastern Lake...

Territorial Department, Revenue Consultation, No. 37. 21st August 1823.

No. 16. Letter from the Canal Committee, dated 30th July 1823, to Mr. Secretary Mackenzie, transmitting the Paper marked No. 15.

Canal Committee's Proceedings, Vol. 1. page 170.

No 17. Letter from the Commissioner of the Soonderbunds, dated 6th August 1823, to Secretary to Canal Committee, transmits the Paper marked No. 17. a. and states that his jurisdiction does not extend beyond the Western Bank of the Juboona River.

Ibid.

No. 17. a. List of the Talookdars or Landholders, to whom the Commissioner of the Soonderbunds has issued Perwannahs.

Territorial Department, Revenue Consultation, No. 38. 21st August 1823.

No. 18. Letter from Secretary to Government, dated 21st August 1823, to Canal Committee, approving of their suggestions for straightening the line of Canal referred to in Papers marked No. 13. No. 15. and No. 16. inclusive.

Ibid, No. 16. 6th November 1823.

No. 19. Letter from Superintendent of Canals, dated 6th October 1823, to Canal Committee, relative to the cost of clearing Jungle, excavating, and price of Labour, &c.

No. 20. Letter from Canal Committee, dated 22nd October 1823, to Superintendent of Canals, approving generally of his suggestions, &c. contained in his Letter of the 6th October 1823, marked No. 19.

No. 21. Letter from Canal Committee, dated 25th October 1823, to Secretary to Government, transmitting the Papers marked No. 19. and No. 20.

Canal Committee's Proceedings, Vol. 2, page 5.

No. 22. Letter from Captain J. A. H. Schalch, dated 25th October 1823, to the Secretary to the Canal Committee, reporting that to avoid delay in carrying into effect the orders of Government of the 10th of April 1823, relative to clearing the head of the Eastern or Balliaghaut Canal and bunding in a passage through the Salt Water Lake, he has entertained an European Overseer to direct the labourers ; that he, Captain Schalch, is at present engaged in marking out the direction of the intended passage through the Lake ; that when that work is completed he will commence excavating the passage ; that he has also directed a small temporary Bungalow to be erected on the borders of the Lake for the residence of the Overseer, and Hooglah Huts for the Labourers.

- No. 23. Letter from Secretary to Government, dated 6th November 1823, to Canal Committee, approving of the instructions of the Committee to the Superintendent of Canals, and sanctioning an advance of Rs. 50,000 per mensem for the Koolna Canal.
- Territorial Department Revenue Consultation No. 18, 6th November 1823.
- No. 24. Letter from Superintendent of Canals, dated 12th December 1823, to Secretary to the Canal Committee, transmitting the Paper marked No. 24. *a*.
- Canal Committee's Proceedings, Vol. 2. page 64.
- No. 24. *a*. Minute by Captain J. A. H. Schalch on the effect the opening of the Hoseinabad Canal will probably have on the manufacture of Salt in its vicinity, and shewing no loss will arise to Government from opening the above Canal.
- Ibid, page 65.
- No. 25. Letter from Secretary to Government, dated 5th March 1824, to the Secretary to the Canal Committee, transmitting the Papers marked No. 25. *a*. to No. 25. *b*. inclusive.
- Ibid, page 139.
- No. 25. *a*. Letter from Board of Customs, Salt and Opium, dated 16th February 1824, transmitting the Paper marked No. 25. *a* $\frac{1}{2}$. and stating that they do not think it advisable to grant the enhancement of one anna per maund on the price of the Salt made in the New Calaries.
- Ibid.
- No. 25. *a* $\frac{1}{2}$. Letter from C. R. Barwell, Esq. dated 12th February 1824, to the Board of Customs, Salt and Opium, stating that by closing the Kooleagong at Ballygunge to secure the Jaboona River from the admission into it of too great a body of Salt Water, the operation of one hundred and fifty-two Calaries on the Northern Bank of the projected Canal will be destroyed, and that about 33 more will be rendered useless in the event of the Ghobra Khaul being bunded; but he concurs in the opinion of the Superintendent of Canals, that all objections may be obviated by removing the Calaries to the Southern side of the Canal.
- Ibid, page 141.
- No. 25. *b*. Letter from Secretary to Government, dated 5th March 1824, to the Board of Customs, Salt and Opium, acknowledging the receipt of their letter of the 16th ultimo, relative to the measure proposed by the Superintendent of Canals for opening the Canal in Hoseinabad and Busserah, that on a consideration of these Papers, His Lordship in Council is satisfied, that the temporary and particular inconvenience likely to result from the closing of the Koolnahgong, and as eventually proposed, of the Gobrah Khaul, is not of sufficient moment to cause any hesitation in the execution of these works if found necessary for the purposes explained by Captain Schalch.
- Ibid, page 143.

Territorial Department Revenue Consultation No. 13.
19th March 1824.

No. 26. Letter from Secretary to Government, dated 19th March 1824, to Secretary to Canal Committee, transmitting Regulation I. 1824, Vide Paper marked No. 26. *a.* and vesting the Committee with the powers provided in Section 3, Clause 2 of said Regulation.

No. 41. 30th July 1824.

No. 26. *a.* Draft of a Regulation for rescinding Regulation IV. 1813, for declaring the rates of Toll to be levied on Boats, Rafts, Timbers, and the like passing through the Bhogaruthee, Jellinghee, Issamuttee, Mattabangah, and Choornee Rivers, and for providing for the better collection of the Toll, and for the secure Navigation of the aforesaid and other navigable Rivers. . .

No. 37. ditto.
* Since ordered to be commenced upon—See Extract of a Dispatch (marked No.—) dated 11th July 1827, of the Court of Directors. The subject appears to have been overlooked.—J. M.

No. 27. Letter from Secretary to Government, dated 30th July 1824, to Canal Committee, transmitting the Papers marked No. 27. *a.* and directing that the Canal to *Diamond Harbour and Channel Creek be suspended, the Kidderpoor Bridge to be completed, and the Canal to Coolna to be reported on.—Vide Papers marked No. 79½. and No. 79½. *a.*

Territorial Department Revenue Consultation No. 37.
30th July 1824.

No. 27. *a.* Extract from the Proceedings of the Right Hon'ble. the Governor General in Council in the Territorial Department, under date the 23rd July 1824, with reference to the Suspension of all Public Works.

No. 21. 24th December 1824.

No. 28. Report dated 19th October 1824, by Major J. A. H. Schalch, transmitting the Paper marked 28. *a.* reporting the state of the Canals under his charge.

No. 22. ditto.

No. 28. *a.* Report by Captain Taylor, dated 28th August 1824, to Superintendent of Canals upon the Canal to Diamond Harbour and Channel Creek.

Canal Committee's Proceedings, Vol. 3. page 149.

No. 29. Letter from Canal Committee, dated 18th November 1824, to Secretary to Government, with reference to the Paper marked No. 27, transmits the Papers marked No. 28. to No. 29. *b.* inclusive.

Ibid.

No. 29. *a.* Abstract Statement, shewing the quantity and value of ground and buildings purchased by the Canal Committee, since their appointment on the 20th March 1823, to 23rd October 1824, as per Dft. No. 1. to No. 47. inclusive.

Ibid.

No. 29. *b.* Abstract Statement of all sums drawn and expended on account of the Canal Works, from their commencement up to the 31st July 1824.

Territorial Department Revenue Consultation No. 23.
24th December 1824.

No. 30. Letter from Secretary to Government, dated 24th December 1824, to Canal Committee, in reply to their Letter of the 18th No-

vember 1824, marked No. 29, states that his Lordship in Council concurs with the Committee in thinking, that the establishment now kept for carrying on the business of the Iron Bridge Department should be continued; that the Survey of the proposed line of the Diamond Harbour Canal appears to have been executed by Captain Taylor in a very satisfactory manner; and that the benefits of that work, or the facilities of executing it have not been overrated; but since the services of Captains Schalch and Baker are not available for the work, it appears expedient to postpone it; that for several reasons, his Lordship prefers keeping the work in the hands of the Government; and any private Society would doubtless labour under much disadvantage if deprived of the services of Captains Schalch and Baker; that the expense incurred for executing the Balliaghat Canal and erecting the temporary Bridge at Kolia is sanctioned; that the early completion of the Channel through the Salt Water Lake is very desirable; and that it is advisable to carry on the general Plan of the Canal to Koolna, though in a modified system, if the services of a competent person, not in the service, could be obtained in place of Lieutenant Prinsep, whose services are required elsewhere.

No. 31. Letter from the Superintendent of Canals, dated 2nd January 1825, to Canal Committee, respecting the state of his account current with the Committee, and stating that he is to quit Calcutta for Chittagong immediately.

No. 20. 23rd April 1825.

No. 32. Letter from Secretary to Canal Committee, dated 21st March 1825, to Secretary to Government, respecting the outstanding balances in the Canal and Iron Bridge Department; and stating with reference to the Paper marked No. 30. that the Committee have not been able to meet with an uncovenanted officer qualified to undertake the Superintendence of the Eastern Canal works; and adverts to Captain Schalch's death and to the services of Captain Taylor.

No. 19. 28th April 1825.

No. 33. Letter from Secretary to Canal Committee, dated 2nd May 1825, to Secretary to Government, transmitting the Papers marked No. 33. *a.* to 33. *e.*⁽¹⁾

Territorial Department Revenue Consultation No. 17. 12th May 1825.

No. 33. *a.* Letter from Captain J. W. Taylor, Assistant Superintendent of Canals, dated 21st March 1825, to Secretary to Canal Committee respecting the obtaining of certain Public Documents from Major Schalch's Executors.

Ibid.

No. 33. *b.* Letter from Secretary to Canal Committee dated 25th March 1825, to Captain J. W. Taylor, Assistant Superintendent of Canals requesting him to take immediate measures to obtain

Ibid.

all the Public Documents pertaining to the Canal Department now in the hands of Major Schalch's Executors.

No. 33. c. Letter from Assistant Superintendent of Canals, dated 11th April 1825, transmitting the Papers marked No. 33. c.(1) to No. 33. c.(3); and stating that there are many private Papers pertaining to Major Schalch's Estate, which it would be advisable to purchase—amongst which is a Plan of a proposed Harbour for Shipping at the Port of Calcutta, and a Plan of a Machine for cutting Piles under water, and a Plan of a Machine for driving Piles.

Territorial Department Revenue Consultation No. 17. 12th May 1825.

No. 33. c.(1) List of Maps, Plans or Sketches relating to or connected with the Canal and Iron Bridge Departments.

No. 33. c.(2) List of Documents and Papers relating to or connected with the Canal and Iron Bridge Departments.

No. 33. c.(3) List of the late Major Schalch's Private Journals.

No. 33. d. Letter from Secretary to Canal Committee, dated 20th April 1825, to Assistant Superintendent of Canals, requesting him to submit a list of all the private Papers and Documents which are likely to prove useful, and to mention what would be a fair remuneration to Major Schalch's Estate for the same. ..

No. 33. e. Letter from the Assistant Superintendent of Canals, dated 28th April 1825, to Secretary to Canal Committee transmitting the Paper marked No. 33. e.(1) and stating that Rupees 400 might be considered a fair remuneration to Major Schalch's Estate for his private Papers, above referred to.

No. 33. e.(1) List of the Private Journals of the late Major J. A. H. Schalch.

Canal Committee's Proceedings, Vol. 5, page 55.

No. 34. Letter dated 19th May 1825, from Secretary to Government to Secretary to Canal Committee, transmitting the Papers marked No. 34. a. and No. 34. a.(1)

Ibid

No. 34. a. Letter from G. Jessop, Esq., dated 9th May 1825, to Secretary to Government, suggesting a *Railroad to Diamond Harbour* in place of the proposed Canal, and transmitting the Paper marked No. 34. a.(1)

Ibid, Vol. 5, page 57.

No. 34. a.(1) Report dated November 20th 1824, to the Committee of the proposed Railway from Cromford to the Peak forest Canal at Whaley Bridge.

Ibid, Vol. 6, page 35.

No. 35. Letter dated 3rd [4th] November 1825, from Secretary to Canal Committee to Lieutenant T. Prinsep, Engineers, Chittagong, requesting his opinion on the following points:—

1. Whether the portions when completed of the Canal to Koolna will prove advantageous, independent of the general Scheme?

2. What local advantages are likely to accrue from completing them?

3. If the completion of them would afford Data to form a judgment of the practicability or difficulty to be anticipated in the execution of Major Schalh's Plan generally, by shewing the action of the tides in them, in forming deposits, or in acting upon their sides.

4. At what expense the Cuts might be completed.

No. 36. Letter from Secretary to Canal Committee, dated 4th November 1825, to the President and Members of the Embankment Committee of the 24-Purgunnahs and Zillah Jessore, relative to the unfinished Cuts of the Canal to Koolna.

Canal Committee's Proceedings, Vol. 6. page 39.

No. 37. Reply by Lieutenant T. Prinsep, dated 13th November 1825, to Secretary to Canal Committee's letter of the 4th November 1825, marked No. 35.

Territorial Department, Revenue Consultation No. 10. 29th December 1825.

No. 38. Letter from Messrs. Jessop and Co., dated 11th November 1825, to Secretary to Canal Committee, transmitting the Paper marked No. 38. a.

Canal Committee's Proceedings, Vol. 6, page 49.

No. 38. a. Estimate by Messrs. Jessop and Co. of the expense of a Railway to Diamond Harbour, and also from head of Dhurum-tollah Road to Balliaghaut.

Ibid, page 50.

No. 39. Letter dated 16th November 1825, from Secretary to Canal Committee to Secretary to Government, transmitting the Papers marked No. 38. and No. 38. a.

Ibid, page 60.

No. 40. Letter dated 16th November 1825, from the Embankment Committee of the 24-Purgunnahs to the Secretary to the Canal Committee, in reply to his letter of the 4th November 1825, marked No. 36.

Territorial Department, Revenue Consultation No. 9. 29th December 1825.

No. 41. Letter from Secretary to Canal Committee, dated 24th November 1825, to Lieutenant T. Prinsep, stating that the Committee would gladly avail themselves of the offer of his services, to visit the scene of his late operation, but that they are not prepared yet to make an application to Government on that point, and that the Questions contained in the letter of the 4th November instant, refer exclusively to the two Cuts which were commenced under his, Lieutenant Prinsep's, Superintendence.

Canal Committee's Proceedings, Vol. 6, page 61. and 62.

No. 42. Letter dated 28th November 1835, from the Embankment Committee of the Zillah Jessore, to Secretary to Canal Committee,

Territorial Department, Revenue Consultation No. 9. 29th December 1825.

in reply to his letter of the 4th November 1825, marked
No. 36.

- No. 10. 24th December 1825. No. 43. Letter from Lieutenant T. Prinsep, dated 8th December 1825, to Secretary to Canal Committee, in reply to his letter of the 24th November 1825, marked No. 41. and replying further to the letter of the 4th November 1825, marked No. 35.
- No. 8. ditto. No. 44. Letter to Secretary to Government, (in reply to his letter of the 6th October, instant) from Secretary to Canal Committee, dated 22nd December 1825, transmitting the Papers marked No. 35 to No. 37 inclusive, and No. 40, 42, and 43, and stating, that, for the purpose of ascertaining how far the Cuts already in progress would be useful to the Inhabitants of the surrounding districts, in the event of their being completed, independent of the general Scheme, according to Major Schalach's Plan, at no very considerable outlay, and whether the works might not be done under the Superintendence of the Officers in charge of the embankments, the Canal Committee had addressed letters to the Members of the Embankment Committee for the 24-Pergunnahs and Zillah Jessore.
- No. 11. ditto. No. 45. Letter from Secretary to Government, dated 29th December 1825, to Canal Committee, stating that His Lordship in Council has resolved to relieve Major Schalach's Estate from the responsibility of the outstanding balances on account of the Koolna Canal, also that Lieutenant T. Prinsep will be directed to Survey the unfinished Cuts of the Koolna Canal.
- Canal Committee's Proceedings, Vol. 7. page No. 46. Letter from Secretary to Government, dated 6th April 1826, to Canal Committee, transmitting the Papers marked No. 46. a. and No. 46. b.
- Territorial Department, Revenue Consultation No. 23. 19th October 1826. No. 46. a. Letter from the Acting Secretary to the Board of Revenue, dated 14th March 1826, to Secretary to Government, transmitting the Paper marked No. 46. b.
- Ibid. No. 46. b. Letter from the Collector of 24-Pergunnahs, dated 3rd March 1826, to Secretary to Board of Revenue, bringing to the notice of the Board the obstructed state of the Eastern Canal, and transmitting the Paper marked No. 46. b.⁽¹⁾
- Ibid. No. 46. b.⁽¹⁾ Copy of a Report from the Tesheldar of the Canal, stating the extent of work performed by Major Schalach in the Eastern Canal and Salt Water Lake Channel, and asserting that the work executed by Major Schalach was very incommensurate with the outlay on the above works.
- No. 24. 19th October 1826. No. 47. Letter from Secretary to Canal Committee, dated 14th April

1826, to the Secretary to Government, stating particulars connected with the work performed by Major Schalch in the Salt Water Lake Channel and Eastern Canal.

No. 48. Letter from Secretary to Government, dated 14th September 1826, to Canal Committee, stating that Lieutenant Prinsep has been directed to place himself under the orders of the Committee, and requesting the Committee to report what pay and allowances should be given him.

No. 24. 14th September 1826.

No. 49. Letter from Secretary to Canal Committee, dated 19th October 1826, to Superintendent of Canals, requesting of him to state what Plan of operation he would propose to follow in the ensuing season, and pointing out that which to the Committee appears the most advisable.

Canal Committee's Proceedings, Vol. 7. page 166.

No. 50. Letter from Secretary to Government, dated 19th October 1826, to Secretary to Canal Committee, stating that the further progress of the Eastern Canal must only extend to the purchase of the land which may be requisite to ensure its ultimate success, and adverting to the late orders from the Honorable Court of Directors on the subject of Public Works.

Territorial Department, Revenue Consultation No. 26. 19th October 1826.

No. 51. Letter from Superintendent of Canals, dated 26th October 1826, to Secretary to Canal Committee, in reply to his letter of the 19th instant marked No. 49, relative to the general scheme of intended operations during the ensuing season.

No. 36. 29th December 1826.

No. 52. Letter from Secretary to Canal Committee, dated 3rd November 1826, to Superintendent of Canals, in reply to his letter of the 26th ultimo, and the Estimate which accompanied it (marked No. 51.)

Ibid.

No. 53. Letter from Superintendent of Canals, dated 9th November 1826, to Secretary to Canal Committee, transmitting a List of the Additional (308 B : 16 C : 8 Ch. :) required to be purchased for the Ooltadanga Canal, and stating that the Channel through the Salt Water Lake has been considered in Major Schalch's Scheme.

Canal Committee's Proceedings, Vol. 8. page.

No. 54. Letter from Secretary to Canal Committee, dated 16th November 1826, to Acting Secretary to Government, in reply to his letter of the 19th ultimo (marked No. 50.) states that the quantity of ground required for the Eastern Canal, in addition to that which has already been purchased, is 388 biggahs, estimated value Rupees 4,65,600.

Territorial Department, Revenue Consultation No. 29. 23rd November 1826.

No. 55. Letter from Acting Secretary to Government, dated 23rd November, 1826, to Secretary to Canal Committee, stating that

Canal Committee's Proceedings, Vol. 8. page.

under the Orders of 19th October last, the Superintendent of Canals will be chiefly engaged in removing the obstructions in the old Eastern Canal, and deepening the Salt Water Lake Channel, and if any land be purchased this season, suggests an arrangement be made for the continuing the Canal progressively from the Westward.

Territorial Department, Revenue Consultation No. 35, 29th December 1826.

No. 56. Letter from Secretary to Canal Committee, dated 2nd December 1826, to the Acting Secretary to Government, in reply to his letter of the 23rd November 1826, transmits the Paper marked No. 56. a.

Ibid.

No. 56. a. Statement of the quantity and value of further ground required for the Circular Canal.

Ibid.

No. 56. b. Report by Lieutenant T. Prinsep, dated 20th November 1826, on the state of the Entally and Balliaghaut Canal.

Ibid.

No. 56. b.(1) Estimate of the expense necessary to deepen the Balliaghat Canal, and reslope the Banks.

Ibid.

No. 57. Letter from Lieutenant T. Prinsep, dated 16th December 1826, to Canal Committee, transmitting the Paper marked No. 57 a.

Ibid.

No. 57. a. Estimate of the probable expense that will be incurred by the general working operations during the season of 1826-27.

Ibid.

No. 58. Letter from Secretary to Canal Committee, dated 20th December 1826, to Secretary to Government, transmitting the Paper marked No. 52, No. 57, and No. 57. a.

No. 37, 29th December 1826.

No. 59. Letter from Secretary to Government, dated 29th December 1826, to Canal Committee, requesting them, before making any bargain for land for widening the Entally Canal, that they will ascertain by a reference to the Office of the Board of Revenue, or that of the Collector of 24-Purgunnahs, how much land was purchased on that occasion, and whether the space requisite to widen the Canal is not now the property of Government.

Ibid.

No. 60. Letter from H. Wood, Esq. Accountant General, dated 31st December 1826, to Acting Secretary to Government, relative to deepening the Entally Canal, and bunding the Channel through the Salt Water Lake.

Canal Committee's Proceedings, Vol. 8, page

No. 61. Letter from the Canal Committee, dated 10th January 1827, to the Secretary to the Board of Revenue, requesting to be furnished with a Statement of the quantity of ground originally purchased by Government for the Entally and Balliaghaut Canal and Roadway. See Papers marked No. 63, and 63. a.

- No. 62. Letter from Secretary to Canal Committee, dated 15th January 1827, to Acting Secretary to Government, stating the modes of payment which would be acceptable to the Proprietors of the land required for Circular Canal.
Territorial Department, Revenue Consultation No. 15. 18th January 1827.
- No. 63. Letter from Secretary to the Revenue Board, dated 19th January 1827, to Secretary to Canal Committee, transmitting the Paper marked No. 63. *a*.
Canal Committee's Proceedings, Vol. 8. page
- No. 63. *a*. Memoranda, shewing the quantity of ground originally purchased in 1807, for the Balliaghaut Eastern Canal.
Ibid.
- No. 64. Letter from Lieutenant T. Prinsep, dated 20th January 1827, to Secretary to Canal Committee, stating that he has made a Survey of the most judicious course to be given to the Chultabariah Canal which he has staked out, and requesting that the Collector of the 24-Purgunnahs be requested to depute an Aumeen to Officially purchase the ground.
Territorial Department, Revenue Consultation, No. 20. 8th February 1827.
- No. 65. Letter from Secretary to Government, dated 25th January 1827, in reply to Secretary of Canal Committee's Letter marked No. 62, to Secretary to Canal Committee, states that His Lordship in Council authorizes the purchase of Land for the Circular Canal on the terms proposed.
No. 16. 25 January 1827.
- No. 66. Letter from Secretary to Canal Committee, dated 29th January 1827, to W. Dampier, Esq. Commissioner of the Soondurbuns, transmitting an Extract of the Paper marked No. 64, and requesting him to depute a proper person to measure the ground which the Superintendent of Canals has marked off, preparatory to excavation, between the Tardah, Bedyadhurrie, and the Bringur Nullah near Chultabariah.
Canal Committee's Proceedings, Vol. 8. page
- No. 67. Letter from the Canal Committee, dated 29th January 1827, to the Acting Secretary to Government, transmitting the Paper marked No. 61.
Territorial Department, Revenue Consultation, No. 20. 8th February, 1827.
- No. 68. Letter from the Secretary to the Canal Committee, dated 29th January 1827, to the Acting Secretary to Government, transmitting for the information of Government, the Papers marked No. 61. to No. 63. *a*. inclusive.
Canal Committee's Proceedings, Vol. 8. page
- No. 69. Letter from the Canal Committee, dated 8th February 1827, to the Acting Secretary to Government, relative to the Plan suggested by Lieutenant Prinsep for widening the Entallee and Balliaghat Canal, Vide No. 56. *b*.
Ibid.
- No. 70. Letter from Acting Secretary to Government, dated 8th February 1827, in reply to Canal Committee's letter of the 29th Janu-

ary, 1827, marked No. 69. states that His Lordship in Council approves of the Plan proposed by the Superintendent of Canals to execute the Chultabariah Canal.

Canal Committee's
Proceedings, Vol. 8.
page

No. 71. Letter from Secretary to Canal Committee, dated 13th February 1827, to Acting Secretary to Government, stating, in reply to his letter of the 25th Ultimo, that a sum of two lacs of Rupees will, in the opinion of the Committee, be sufficient for the present to carry on the purchases of land.

Ibid.

No. 72. Letter from Lieutenant T. Prinsep, dated 19th March 1827, to Secretary to Canal Committee, transmitting the Papers marked No. 72. *a.* and No. 72. *b.* and stating that he has prepared an accurate Survey of the Eastern Canal, shewing the boundaries of the several properties adjoining, and that he is able to state with certainty where encroachments have been made on the ground purchased in 1807-8, and remarking generally on the state of the Eastern Canal.

Ibid.

No. 72. *a.* List of encroachments that appear from the present breadth to have been made upon the Hon'ble. Company's land along the Banks of the Balliaghat and Entally Canals.

Ibid.

No. 72. *b.* Account of the quantity of ground required to be purchased to complete the breadth of the Road on the South Bank of the Canal to 24 feet.

Ibid.

No. 73. Letter from Superintendent of Canals, (Lieutenant T. Prinsep), dated 4th April 1827, to Secretary to Canal Committee, respecting the Oaltadanga Canal.

Ibid.

No. 74. Letter from Secretary to Canal Committee, dated 7th May 1827, to Superintendent of Canals, in reply to his letter of the 4th April 1827, marked No. 73.

Ibid.

No. 75. Letter from Secretary to Canal Committee, dated 11th May 1827, to the Accountant General, transmitting the Papers marked No. 75. *a.* and objecting to certain charges in the *A. C.* transmitted in his letter of the 7th Ultimo.

Ibid.

No. 75. *a.* Statement of Charges in Mr. Wood's *A. C.* dated 7th April 1827, relative to the Eastern Canal, which are deemed inadmissible.

Canal Committee's
Proceedings, Vol. 9.
page

No. 76. Letter from Accountant General, dated 4th June 1827, to Secretary to Canal Committee, transmitting an amended *A. C.* of the Canal charges.

Ibid.

No. 76. *a.* Extract—Proceedings of the Hon'ble. the Vice-President in

Council in the Military Department, under date the 5th May 1818.

No. 77. Letter from Lieutenant T. Prinsep, dated 9th June 1827, to Secretary to Canal Committee, bringing to his notice several circumstances to the detriment of Navigation of the Lake Channel, also some abuses which appear greatly to need the interference of the Police or executive power, as guardians of the thoroughfares.

Canal Committee's
Proceedings, Vol. 9.
page

No. 78. Letter from Secretary to Canal Committee, dated 18th June 1827, to the Magistrate of the 24-Pergunnahs, transmitting the Paper marked No. 77.

Ibid.

No. 79. Letter from the Magistrate of the 24-Pergunnahs, dated 25th August 1827, to the Secretary to the Canal Committee, stating that on receipt of his letter of the 18th June instant, he had adopted measures for clearing the Salt Water Lake Channel of the obstructions complained of by the Superintendent of Canals.

Territorial Department Revenue
Consultation, No.
52. 30th August
1827.

No. 80. Letter from Secretary to Canal Committee, dated 28th August 1827, to Secretary to Government, transmitting the Paper marked No. 79.

No. 81. Letter from Superintendent of Canals, dated 28th August 1827, to Secretary to Canal Committee, detailing the progress made in the construction of the several branches of works commenced by him since his appointment as Superintendent of Canals, as noticed in the Paper transmitted, marked No. 81. a. to No. 81. f.⁽¹⁾

Ibid. No. 24. 27th
September 1827.

No. 81. a. Report on Balliaghaut or Eastern Canal.

Ibid.

No. 81. b. Report on Dredging Machinery and operations in the Channel of the Salt Water Lake.

Ibid.

No. 81. c. Report on Chultabariah Canal.

Ibid.

No. 81. d. Report on Ballygunge Canal and Dam across the Kullooar Khall.

Ibid.

No. 81. e. Report on clearing and bunding the Bhowaneepore Canal. ..

Ibid.

No. 81. f. Proposed scheme for the operations of the approaching year 1827-28.

Ibid.

No. 81. f.⁽¹⁾ Estimate to accompany ditto.

Ibid.

No. 82. Letter from Secretary to Government, dated 30th August 1827,

Territorial Department, Revenue Consultation, No. 53. 30th August 1827.

to Secretary to Canal Committee, stating that the bill submitted by the Magistrate of 24-Pergunnahs for the purchase of a Country boat for removing obstructions in the Lake channel is passed, and sanction given to the Magistrate to entertain an establishment for the above boat.

Canal Committee's Proceedings, Vol. 9. page

No. 83. Letter from Captain T. Prinsep, dated 31st August 1827, to Secretary to Canal Committee, stating that the water of the Salt Water Lake has the effect of turning the Iron fastenings of the tin-bottomed Dredging Boats, into a kind of paste. ..

Territorial Department, Revenue Consultation, No. 23. 27th September 1827.

No. 84. Letter from Secretary to Canal Committee, dated 10th September 1827, to Secretary to Government, transmitting with the Canal Committee's suggestion, the Papers marked No. 81. and No. 81. *a.* to No. 81. *f.*⁽¹⁾

Canal Committee's Proceedings, Vol. 9. page

No. 85. Letter from Secretary to Canal Committee, dated 14th September 1827, to Superintendent of Canals, requesting to be furnished with a full and particular Report on the present state of Tolly's Nullah.

Ibid. No. 25.

No. 86. Letter from the Acting Secretary to Government, dated 27th September 1827, to Secretary to Canal Committee, in reply to his letter of the 10th instant, in which was conveyed the detailed Report, &c. submitted by the Superintendent of Canals, whose ingenious application of the principle of producing a current to deepen the channel of the Canal, when its bed reaches oozing sand, meets His Lordship's approval.

Territorial Department, Revenue Consultation, No. 33 25th October 1827.

No. 87. Letter from Superintendent of Canals, dated 8th October 1827, to Secretary to Canal Committee, transmitting the Papers marked No. 87. *a.* and reporting upon the means of keeping open the Navigation of Tolly's Nullah throughout the year, and recommending the use of Shutter Dams, and stating that the use of Dredging Machinery in Tolly's Nullah would be expensive and inefficient.

Ibid.

No. 87. *a.* Memoranda on the construction of a Shutter Dam.

Ibid.

No. 88. Letter dated 15th October 1827, from Secretary to Canal Committee to Acting Secretary to Government, transmitting the Papers marked No. 87. and 87. *a.*

Ibid. No. 32. 6th December, 1827.

No. 89. Letter from Superintendent of Canals, (Captain T. Prinsep, Engineers,) dated 31st October 1827, transmitting the Papers marked No. 89 *a.* to No. 89. *f.* inclusive.

Ibid.

No. 89. *a.* A Memoir by the Superintendent of Canals on the subject

of the proposed Canal of communications, between Hooghly at Chitpore and the Balliaghaut Canal, and suggesting certain alterations in modification of the plan of that work as prepared by the late Major Schalch.

No. 89. <i>b.</i> Plan of manœuvering the Gates referred to in the above Memoir.	Territorial Department, Revenue Consultation, No. 32, 6th December, 1829.
No. 89. <i>c.</i> Estimate of the probable expense that will attend the construction of Tide Gates and Bridges referred to in the Memoir.	Ibid.
No. 89. <i>d.</i> General Estimate of the probable expense attending the construction of the Circular Canal, agreeably to the scheme proposed by Major Schalch in his Memoir and Appendix. . .	Ibid.
No. 89. <i>e.</i> General Estimate attending the construction of the Circular Canal, agreeably to the scheme proposed by the Superintendent of Canals, (Captain T. Prinsep of Engineers.)	Ibid.
No. 89. <i>f.</i> Chart of Tides in the River and Lake.	Ibid.
No. 90. Letter from Secretary to Canal Committee, dated 19th November 1827, to the Acting Secretary to Government, transmitting the Paper marked No. 89, and No. 89. <i>a.</i> to No. 89. <i>f.</i> inclusive...	Ibid.
No. 91. Letter from Superintendent of Canals, dated 26th November 1827, to Secretary to Canal Committee, stating that the part of Bahminghatta Canal, which traverses the cultivated country, has been staked out, and requesting that the ground may be measured by Aumeens.	Canal Committee's Proceedings, Vol. 10. page
No. 92. Letter from Secretary to Canal Committee, dated 28th November 1827, to Acting Secretary to Government, transmitting copy of the Paper marked No. 91. and requesting that the necessary communication may be made to the Soonderbunds Commissioner, to take the requisite measures for measuring the ground referred to at Bahminghatta.	Ibid.
No. 93. Letter from Acting Secretary to Government, dated 6th December 1827, to Secretary to Canal Committee, directing that other competent Engineer Officers and other persons be consulted on the subject of the Superintendent's of Canals Memoir. See Paper marked No. 89. to No. 90. inclusive. . .	Territorial Department, Revenue Consultation, No. 33. 6th December 1827.
No. 94. Letter from Secretary to Government, dated 18th December 1827, to Secretary to Canal Committee, transmitting the Paper marked No. 94. <i>a.</i>	Canal Committee's Proceedings, Vol. 10. page
No. 94. <i>a.</i> Extract Para. 87 to 91 of a Despatch, dated 11th July 1827,	Ibid.

from the Honorable Court of Directors, *directing that the Canal to Channel Creek may be commenced upon.*

Territorial Department Revenue Consultation No. 13. 6th January 1829.

No. 95. Letter from Captain John Colvin, Superintendent of Canals, Delhi Territory, dated 1st March 1828, transmitting the Paper marked No. 95. a.

No. 95. a. Answers by Captain John Colvin to the Queries transmitted to him by the Secretary to the Canal Committee on the subject of the Superintendent of Canal's Memoir, marked No. 89. a.

No. 96. Letter from Superintendent of Canals, dated 3rd May 1828, to Secretary to Canal Committee, stating that he has been compelled to abandon operations at the Kulloar Dam for this season from a variety of causes ; and requesting orders relative to opening the Hossennabad Canal ; and advertng to a communication held with Zemindars interested on the subject of the Dam, on which the expense already incurred has been about Rs. 12,000 ; and stating that a second attempt will cost about Rs. 15,000, and requesting the orders of Government on the subject.

Ibid, No. 5. 29th May 1828.

No. 97. Letter from Secretary to Canal Committee, dated 8th May 1828, to Superintendent of Canals, stating that the Committee will postpone submitting his letter of the 3rd instant to the Government, until the final determination of the Zemindars regarding the extent of the aid they would afford in the event of a second attempt being made, to complete the Kulloar Dam.

No. 98. Letter from Superintendent of Canals, dated 19th May 1828, to Secretary to Canal Committee, stating that the Zemindars have come to no decision as yet relative to the Kulloar Dam, and that their object appears to prevent the opening of the Hossennabad Canal, and recommending the subject to be brought to the notice of Government.

No. 99. Letter from Superintendent of Canals, dated 22nd May 1828, to Secretary to Government, transmitting the Papers marked No. 96. to No. 98. inclusive.

Canal Committee's Proceedings Vol. 11. page

No. 100. Letter from the Superintendent of Canals, dated 30th May 1828, to Secretary to Canal Committee, transmitting the Paper marked No. 100. a.

No. 100. a. Petition dated from the Zemindars of Myhuttee and Augurpara, on the danger of opening the Hossennabad Canal into the adjoining districts.

	PAGE.
No. 101. Letter from Secretary to Government, dated 29th May 1828, to Secretary to Canal Committee, stating that the operations for closing Kulloar Dams are not to be renewed at the expense of Government, and if the Zemindars make no specific proposition, the mouth of the Nullah to be excavated.	Territorial Department, Revenue Consultation No. 6. 29th May 1828.
No. 102. Letter from the Superintendent of Canals, dated 22nd August 1828, to Secretary to Canal Committee, transmitting the Papers marked No. 102. a. to No. 102. c. detailing his operations on the Eastern lines of Canals during the season of 1827-28, and other works connected therewith.	Canal Committee's Proceedings, Vol. 11. page
No. 102. a. Report of Dredging Machinery and operations in the Channel of the Salt Water Lake.	
No. 102. b. Report on the Bhowanepore Canal.	Canal Committee's Proceedings, Vol. 11. page
No. 102. c. Report on the Kulloar Dam and works connected with the Canal at Hossennabad.	Ibid.
No. 103. Letter from Secretary to Canal Committee, dated 8th September 1828, to the Secretary to Government, transmitting the Superintendent's of Canals Report, dated 22nd August 1828, marked No. 102. a. to 102. c. inclusive.	Ibid.
No. 104. Letter from Secretary to Canal Committee, dated 19th September 1828, to Secretary to Government, stating that 170 Bigahs of more ground remain to be purchased, and requesting that an assignment to the amount of (3,00,000) Three Lacks may be made in the Committee's favor to meet the purchases.	Ibid.
No. 105. Letter from Secretary to Government, dated 28th September 1828, to Secretary to Canal Committee, stating that the Government approves of the purchase of the ground required to complete the Circular Canal, and to effect which an assignment of Three Lacks will be granted on the Sub-Treasurer's...	Ibid.
No. 106. Letter from Secretary to Government, dated 2nd October 1828, in reply to Secretary to Canal Committee's letter of the 8th September 1828, marked No. 103.	Ibid, Vol. 12. page.
No. 107. Answers by Captain W. N. Forbes, Engineers, dated 24th October 1828, to the above Queries, submitted to him on the subject of the Superintendent's of Canals Memoir, marked No. 89. a.	Territorial Department, Revenue Consultation No. 14. 6th January 1829.
No. 108. Ditto by Captain W. R. Fitzgerald, Engineers, dated to the above Queries.	Ibid, No 15.

- Ibid, No. 16. No. 109. Ditto by J. Kyd, Esq., dated to the above Queries.
- Ibid, No. 12. No. 110. Ditto by Major Joseph Taylor, dated 27th October 1828, to Ditto.
- Ibid, No. 11. No. 111. Letter from Secretary to Canal Committee, dated 3rd November 1828, to Secretary to Government, transmitting the Queries put to several Engineer Officers and others, with their Answers thereto marked No. 95. a. and 107. to 110. inclusive, on the subject of the Superintendent of Canals' Memoir, marked No. 89. a.
- Ibid, No. 17. No. 112. Letter from Secretary to Government, dated 6th January 1829, to Secretary to Canal Committee, stating that His Lordship in Council approves generally of the Plan proposed by the Superintendent of Canals in his Memoir, and desires that Officer may be directed to take the necessary measures for carrying it into effect.
- Ibid, No. 1. 14th April 1827. Ibid, No. 12. No. 113. Letter from Superintendent of Canals, dated 26th March 1829, to Secretary to Canal Committee, recommending the substitution of Draw Bridges for Suspension Bridges over the New Circular Canal.
- No. 114. Letter from Secretary to Canal Committee, dated 3rd April 1829, to Superintendent of Canals, bringing to his notice certain objections to his proposition of the substitution of Draw Bridges for those of Suspension, and requesting of him to state the difference, if any, in the cost of the two kinds of Bridges.
- No. 115. Letter from Superintendent of Canals, dated 4th April 1829, to Secretary to Canal Committee, meeting the objections against Draw Bridges in place of those of Suspension.
- No. 116. Letter from Secretary to Canal Committee, dated 9th April 1829, to Officiating Secretary to Government, transmitting the Papers marked No. 113. to No. 115. inclusive.
- Territorial Department, Revenue Consultation No. 2. 14th April 1829. No. 117. Letter from Secretary to Government, dated 14th April 1829, to Secretary to Canal Committee, directing that the original proposition of Suspension Bridges for the Circular Canal be adhered to.
- Ibid, No. 1. 10th November 1829. No. 118. Annual Report, dated 19th September 1829, from the Superintendent of Canals, relative to his proceedings during the past season.
- Ibid, No. 2. ditto. No. 118. a. General Abstract of expenses for Mofussil works, for the season 1828-29, up to 1st July 1829.

	PAGE.
No. 118. <i>b.</i> General Abstract of expenses for Circular Canal, for the season 1828-29, up to 1st August 1829.	Ibid, No. 2. 10th November 1829.
No. 118. <i>c.</i> Account of balance left Outstanding on the different works in the Canal Department, from the year 1826 to 1829.	No. 3. ditto. No. 4. ditto.
No. 119. Letter from Secretary to Canal Committee, dated 14th October 1829, to Superintendent of Canals, requesting to be furnished with separate minute Estimates of the description of Bridges alluded to in his last Report.	Canal Committee's Proceedings, Vol. 14. page
No. 120. Letter from Superintendent of Canals, dated 15th October 1829, to Secretary to Canal Committee, replying to his letter of the 14th instant, marked No. 119.	Ibid.
No. 121. Letter from Secretary to Canal Committee, dated 16th October 1829, to Superintendent of Canals, requesting to be furnished with a Statement of the method and expense of constructing the Embankments through the Salt Water Lake, proposed by him in the 11th Para. of his last Report.	Ibid.
No. 122. Letter from Secretary to Canal Committee, dated 26th October 1829, to Secretary to Government, transmitting the Paper marked No. 122. <i>a.</i>	Territorial Department, Revenue Consultation, No. 1. 10th November 1829.
No. 122. <i>a.</i> Extract of a letter, dated 26th August 1829, from the Superintendent of Canals, to Secretary to Canal Committee, requesting permission to make a slight alteration in the line of the proposed New Canal, and stating that it will not be attended with any expense.	Ibid.
No. 123. Letter from Acting Secretary to Canal Committee, dated 31st October 1829, to Deputy Secretary to Government, transmitting the Papers marked No. 118. and No. 118. <i>a.</i> to No. 118. <i>c.</i> inclusive.	Ibid, No. 1. 3rd November 1829.
No. 124. Letter from Deputy Secretary to Government, dated 10th November 1829, to Secretary to Canal Committee, in reply to his letter of the 31st October 1829, and its enclosures, marked No. 118. No. 118. <i>a.</i> to No. 118. <i>c.</i> expresses satisfaction at the progress made by the Superintendent of Canals in the past season 1828-29, and sanctions the disbursements proposed for the prosecution of works in the ensuing season.	Ibid, No. 5. 10th November 1829.
No. 125. Letter from the Members of Canal Committee, dated 26th January 1830, to Secretary to Government, stating that in consequence of the death of the Superintendent of Canals, (Captain T. Prinsep,) they have requested Captain Fitzgerald to assume charge temporarily, of the office work of the late Superin-	Canal Committee's Proceedings, Vol. 14. page

tendent until the decision of Government, nominating the individual selected to supply the vacancy, shall have been communicated to them.

Canal Committee's
Proceedings, Vol. 14.
page

No. 126. Letter from Captain W. R. Fitzgerald, in charge of the Office of Superintendent of Canals, dated 8th February 1830, to Secretary to Canal Committee, transmitting an account relative to the works entrusted to the late Superintendent of Canals for the month of November 1829, and stating that the progress of the several works under his charge, owing to the satisfactory arrangements made by the late Superintendent, has not been impeded by the death of the Superintendent. . .

Ibid, Vol. 14. page

No. 127. Letter from Secretary to Government, dated 23rd February 1830, to Members of the Canal Committee, stating that the Governor General has been pleased to assign to Mr. James Prinsep the duty of completing the Circular Canal, and that he has been directed to place himself in communication with the Committee.

Ibid, Vol. 15.
page

No. 128. Letter from Superintendent of Canals, dated 15th September 1830, to Secretary to Canal Committee, transmitting the Papers marked No. 128. a. to No. 128. a.⁽⁵⁾ inclusive. . .

No. 128 a. Report on Canal operations during the year 1829-30. . .

No. 128. a.⁽¹⁾ General Abstract of expenses for Mofussil works for the season of 1829-30, from July to 30th June 1830.

No. 128. a.⁽²⁾ Ditto of Circular Canal for ditto from 1st August 1829, to 30th June 1830.

No. 128. a.⁽³⁾ List of Outstanding Balances to 30th June 1830. . .

No. 128. a.⁽⁴⁾ Comparison of the depth of water in the Eastern Canal on the 26th December 1827, and after dredging on the 9th September 1830.

No. 128. a.⁽⁵⁾ Statement of the Boats passing through the Bahminghatta Canal.

Ibid, Vol. 15.
page

No. 129. Letter from Secretary to Canal Committee, dated 4th November 1830, to Superintendent of Canals, requesting him to state his opinion on the Question of reconstructing the Kullooar Dam, and to furnish an estimate of the probable cost of doing so. . .

Ibid.

No. 130. Letter from Superintendent of Canals, dated 3rd December 1830, to Secretary to Canal Committee, relative to the expediency of reconstructing the Kullooar Dam.

	PAGE.
No. 131. Letter from Superintendent of Canals, dated 3rd December 1830, to Secretary to Canal Committee, transmitting a Supplement to the scheme of works for the season 1830-31, in continuation of his Annual Report, dated 15th September 1830.	Canal Committee's Proceedings Vol. 15. page
No. 132. Letter from Secretary to Canal Committee, dated 20th December 1830, to the Sub-Treasurer, stating that the Records of the Canal Committee's Office have this day been made over to the Secretary to the Military Board, agreeably to the Orders of the Right Hon'ble the Governor General, as promulgated in the Government Gazette of the 16th instant. ..	ibid.

NOTE.—For a Continuation of the above Papers, See Papers selected from the Military Board's Proceedings the Canal Department.—J. M.



Papers pertaining to the Index of Appendix (H) subsequently obtained.—J. M.

	PAGE.
No. 24 $\frac{1}{2}$. Letter from Secretary to Government, dated 20th February 1824, No. 188, to the Canal Committee, in reply to their letter of the 21st January 1824, appoints Captain Baker as Assistant to Captain Schalch, in the Suspension Bridge Department,	
No. 29 $\frac{1}{2}$. Letter from Captain Baker, dated the 18th November 1824, to Canal Committee, stating, that agreeably with instructions received from Major Schalch, he had taken charge of the Iron Bridge Department from the 1st instant,	
No. 32 $\frac{1}{2}$. Letter from Secretary to Government, dated 28th April 1825, to Canal Committee, in reply to their letters of the 16th and 21st of March last, states, that no Military Officer having been available, and since no uncovenanted person qualified to undertake the Superintendence of the Eastern Canal works can be met with, all thoughts of active operations this season must be relinquished; that Captain Taylor's health does not admit of his being employed in the execution of the above work, accordingly his services have been transferred to the Department under the late Major Schalch,	
No. 51. a. Estimate of expense required to construct a Dredging Machine to rest upon two Native Boats, strongly bound together, ..	200
No. 53 $\frac{1}{2}$. Letter from Secretary to Canal Committee, dated 14th November 1826, to H. T. Prinsep, Esq., Acting Secretary to Government, transmitting the Paper marked No. 51 a., and recommending the outlay therein referred to be sanctioned, ...	
No. 56 $\frac{1}{2}$. Letter from Secretary to Canal Committee, dated 5th December 1826, to Superintendent of Canals, in reply to his Letter of the 20th ultimo, states, that his Letter marked No 56 b., and its enclosure, have been transmitted to Government for its consideration and orders,	144
No. 71 $\frac{1}{2}$. Letter from Secretary to Canal Committee, dated 19th February 1827, to Superintendent of Canals, transmitting copy of the Paper marked Nos. 63 and 63 a., and stating, that His Lordship had been pleased to sanction the execution of the work in the manner suggested by the Superintendent, ...	147

NOTE.—Those Papers of the Index to Appendix (H) which contain no reference to the pages of that Appendix, have not been deemed by the Municipal Committee necessary to be printed.—J. M.

	PAGE.
No. 72. c. Estimate of the expense of widening and laying a pukka Road of 24 feet breadth, from the disembogement of the Ooltadangah Canal, Westward to the Dhurruamtollah main exit, with a 2 feet Drain on the Land-side,	150
No. 72 $\frac{1}{4}$. Letter from Secretary to Canal Committee, dated 27th March 1827, to Superintendent of Canals, requesting to know whether the same want of tenacity in the soil of the Banks of the Canal exists to the whole way from the Cooleah Bridge East to Balleaghat, in which case it would be useless constructing the pukka Road,	151
No. 72 $\frac{1}{2}$. Letter from Secretary to Canal Committee, dated 11th May 1827, to Acting Secretary to Government, requesting to know how the Committee shall proceed to recover the 18 Cottahs and 12 Chittacks of Canal Land on the South Bank of the Canal,	Ibid.
No. 102. a. $\frac{1}{4}$. Report on the New Canal between Ghoonamagee and Kantatullah and thence to Bahminghatta,	96
No. 102. a. $\frac{1}{2}$. Report on the Chultabareah Canal, and works executed in connection with it,	97
No. 102. c. $\frac{1}{4}$. Eastern Canal Road, and other miscellaneous work, ..	100
No. 102. c. $\frac{1}{2}$. Scheme for Moffussil operations during 1828-29. ..	101

APPENDIX (H)

No. 2. a.

TO HOLT MACKENZIE, ESQ.

Secretary to Government.

SIR,

I have the honor to acknowledge the receipt of your letter of the 27th February last, with its enclosures, relating to the head of the Eastern, or Balliaghaut Canal.

In reply I beg leave to observe, that the part of the Canal alluded to, has been for a length of time in an unnavigable condition, from the cause assigned by Mr. Trower; viz. the quantity of mud and filth poured into it from the town.

The obstruction extends from the head of the Canal to the Bridge at Cooleah, a distance of 5,250 feet, in which extent the average depth of water does not exceed one foot. The breadth averages 60 feet.

It appears to me, that the cause of this obstruction would be in a great measure removed, if the Canal were under the influence of the Tides from the Sunderbunds; a considerable quantity of the filth of the Town, which is now deposited, from the stagnant state of the Canal, would then be carried out by the Ebb into the deep Sunderbund Passages, to the Eastward of the Salt Lake. Another advantage that would result from the entrance of the Tide into the Canal would be, an accumulation of water at high water, which would allow boats of a greater burden to navigate it, than can do so at present. The probable rise would be three feet.

From a Survey I made of the Salt Lake, I found that, at a distance into the Lake of 7,800 feet from the Eastern extremity of the Canal, the bed of the Lake is dry at low water; and is only partially covered by the Tide during the Flood, and that a deep and broad Nullah there commences, which forms a passage for the Tide from the Sunderbunds to the low parts of the Lake, near the mouth of the Canal.

In order therefore to conduct the Tide into the Canal, nothing further would be required than to prevent its spreading over the surface of the Lake. This could be effected by raising bunds along the sides of the above-mentioned Nullah, from Bamingutta on the Eastern side of the Lake, to the spot in the Lake before mentioned, and continuing them to the mouth of the Canal at Balliaghaut.

The expense of this operation will not be considerable, and will be more than compensated by the tolls on the additional number of boats which would then enter the Canal, instead of depositing their cargoes, as is done at present, outside the Canal at Balliaghaut.

The adoption of this plan will likewise be favorable to that of the great Eastern Canal, lately authorized by Government to be carried into execution, of which indeed it forms a part.

The expense of deepening the Canal, from its head to the Bridge at Cooleah, and of the Bunds from Bomingotta to the mouth of the Canal, will probably be as follows :—

Length from the Bridge to the head of the Canal, ...	3,250 feet.
Breadth,	60 feet.
Depth,	5 feet.
Total cubic contents,	9,75,000

The depth of the excavation being between 18 and 25 feet below the surface of the ground, the cost per 100 cubic feet, according to the established rates in Calcutta, would amount to two annas ten pie. In the present instance, however, a considerable allowance must be made for freeing the part to be excavated from water, and for the distance it will be necessary to carry the earth from the bank. The above rate will therefore probably be doubled, or 5 annas 8 pie per 100 cubic feet. Excavating 9,75,000 cubic feet at this rate, will amount to Sicca Rupees, 3,454 0 0

Bunding in the Channel on both sides through the Lake by mounds 4 feet high, and averaging 8 feet broad ; a distance of 6 miles, at 10 Rs. per hundred running feet,	Sicca Rs. 6,331 0 0
Total,	Sicca Rs. 9,785 0 0

In reply to the 2nd Paragraph of your letter, I beg leave to say, that I could undertake to clear the Canal in question, without interruption to my other duties.

I trust I shall be excused the liberty I take in calling the attention of Government to the Cooleah Bridge, above mentioned, which is at present in so ruinous a condition, as to threaten destruction to boats passing under it. From the sinking of the piers, the Bridge has fallen about 4 inches at the launches ; many of the arch bricks have been displaced, and others are daily giving away. The immediate removal of this Bridge appears to be a measure of indispensable necessity, not only to insure the safety of those navigating the Canal, but to render the improvement of the head of the Canal useful to its fullest extent. At present, boats exceeding 100 maunds burden cannot frequent the head of the Canal, owing to the contracted span of the Cooleah Bridge.

I have the honor to be,

Sir,

Your obedient servant,

J. AUGUSTUS SCHALCH,

Deputy Assistant Quarter Master General.

CALCUTTA,
5th April 1823.

No. 5.

To CAPTAIN JACKSON,

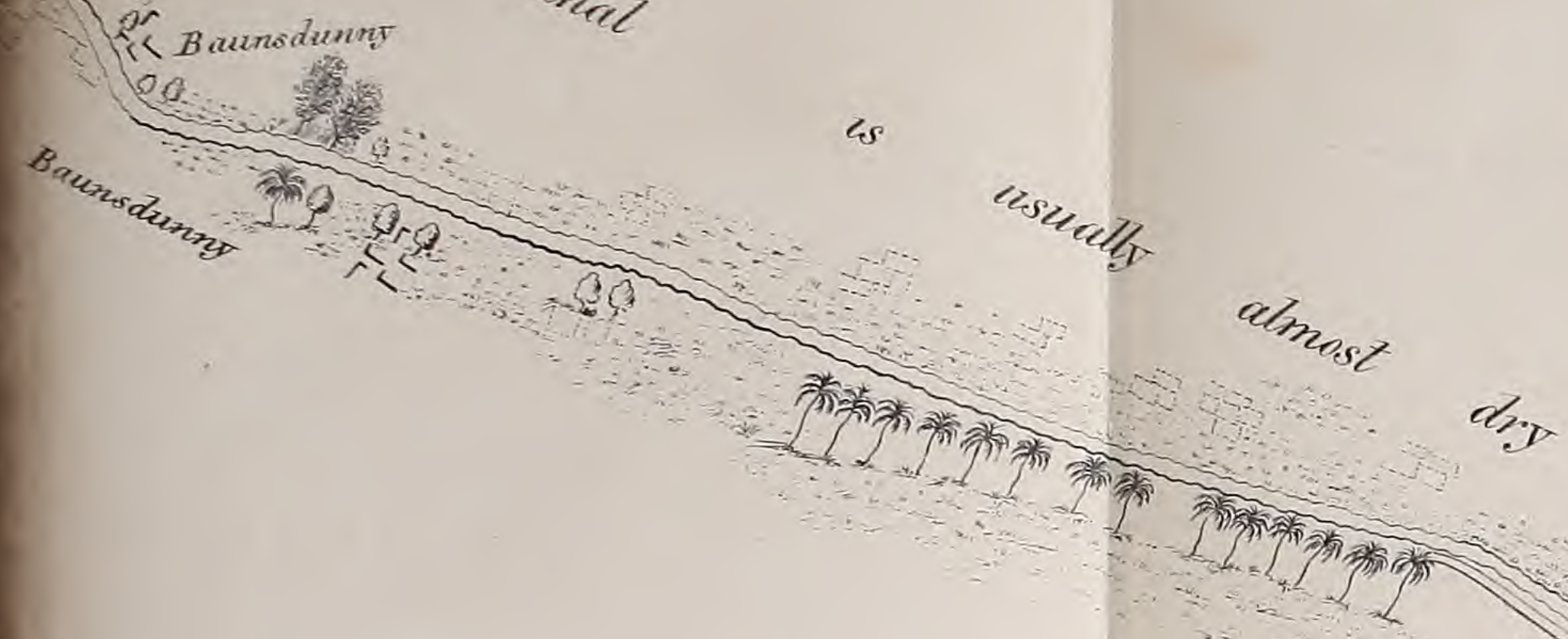
Assistant Quarter Master General, and Secretary to the Canal Committee.

SIR,

I have the honor to Report to the Canal Committee, for the information of Government, that I have completed a minute examination* of Tolly's Nullah ; have taken numerous Sections of it, and obtained the most accurate information on every point connected with its present unnavigable condition.

* Search has been made among the Original Proceedings of the late Canal Committee for this Paper, but with no success. If it were known where the late Major Schalch's private Documents, which it is believed were purchased by the Government, are lodged, possibly among them the above paper would be found.—J. M.

This Part of the Canal



is usually almost dry at

Low



Bustungaula

and Goryahaut

Goryahaut

SURVEY

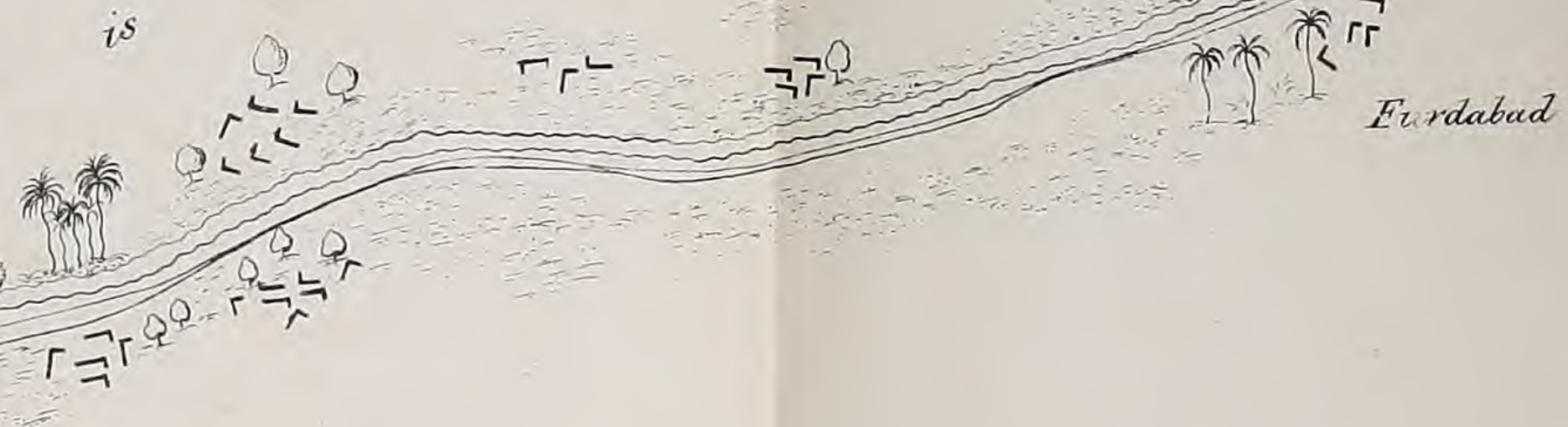
of

TOLLEYS CANAL

SHEET N^o 2

SCALE OF YARDS

is only Navigable during the Spring



Furdabad

High water 5 1/2 fathoms near late June 96
Lowest water 20 fms. water

low water 19

I was about to lay a full Report on the State of the Nullah before Government, when the Order for the formation of the Channel Creek Canal was communicated to me by the Committee. In consequence of this Order, it becomes necessary to consider the former undertaking solely with reference to its probable effects on the latter. The two have therefore become so intimately blended, that they can no longer be considered in a separate light. I trust I shall in consequence meet with the sanction of Government to my refraining at present from any distinct report on Tolly's Nullah. The Plans and Sections I have made of the Nullah, together with the information I have collected in my Survey of it, will of course be laid before the Canal Committee.

In the mean time I am preparing materials for the information required by the 9th Paragraph of the Resolution of Government under date the 23d ultimo.

I have the honor to be,

Sir,

Your obedient servant,

(Signed) J. A. SCHALCH.

(A True Copy.)

JAMES JACKSON, *Captain,*

Secretary to the Canal Committee.

CALCUTTA,
15th May 1823.

No. 6.

To CAPTAIN JACKSON,

Assistant Quarter Master General, and Secretary to the Canal Committee.

SIR,

In reply to your letter of the 14th instant, I beg leave to offer to the Committee the following observations on the points therein referred to :—

It will not admit of a doubt that at present Tolly's Nullah is so much crowded with Boats from the Upper and Eastern parts of the Country, that it could not be made available to any extent as a Channel of communication between Calcutta and the proposed Saugor Canal, yet it does not appear to me, that an objection in consequence lies to the immediate commencement of that Canal. On the contrary, by carrying on the Saugor and Eastern Canals in concert, it may be expected that they will both be completed about the same period, and consequently, that Tolly's Nullah will then be left free for the Saugor Navigation.

An objection may be urged to prosecuting both operations at the same time, that a number of hands will be employed on the Saugor Canal that might be placed with more advantage on the other. From the inquiries, however, that I have lately made on this point, and from the populousness of the country through which the line of the former Canal runs, I am led to believe that there is a considerable portion of the inhabitants of the adjacent villages, who would willingly work as day labourers in the immediate neighbourhood of their houses, who could not be prevailed on to accept employment at a distance. It would of course be advisable to confine the operations of the Saugor Canal as much as possible to this class.

With regard to that part of the 9th Paragraph of the Resolution of Government, relating to the construction of Bridges over Tolly's Nullah, from which I infer, that it is the intention of Government to substitute, in lieu of the present ones, others better adapted to the

free navigation of the Nullah, I beg leave to observe, that the removal of the present wooden Bridges is a measure indispensable to the unobstructed navigation of the Nullah. Not only do their confined arches impede the general velocity of the stream, and consequently accelerate the deposition of mud and sand, but so great a rush of water takes place immediately under the Bridges as to render the passage through at all times difficult and dangerous, and sometimes impracticable. During the time I was employed in the Survey of the Sunderbunds I had frequent occasion to pass under those Bridges, I do not recollect ever having done so without some accident occurring either to the boats or crews. Independent of the difficulty and danger of passing under the Bridges, an idea may be formed of the delay which they occasion, from the fact, that the Kidderpoor and Allepoor Bridges can only be passed at high water, owing to the quantity of bricks and other hard substances which it has been found necessary to throw in to preserve the bed, whilst the Tolly Gunge Bridge, from being so low, can only be passed at the lowest state of the Tide. The consequence of which is, that the accumulation of boats in the immediate vicinity of the latter Bridge is at times so great, that the Nullah becomes obstructed to a degree to preclude entirely a passage through.

I would therefore earnestly recommend to the Committee to adopt measures for the immediate removal of these Bridges, and to substitute in lieu of them, others on the Suspension principle, which will effectually remedy the evils above enumerated.

The Kidderpoor Bridge is now in so dilapidated, and even so dangerous a condition, that its removal would be advisable on these grounds alone.

The Tolly Gunge Bridge is also in a bad state of repair, and is besides of dimensions inadequate to the number of men and carriages which now pass over it. I would therefore suggest to the Committee, that the removal of these Bridges be first taken into consideration.

I am now preparing, and have nearly completed, plans of the sides of the Bridges, together with plans of the proposed improvement, which I shall do myself the honor of laying before the Committee at an early period. I shall only observe on this head, that new Bridges on the above principle can be constructed without interfering materially with the present passage. Understanding that it is the intention of Government to erect a Bridge near the mouth of the Nullah, to form a shorter communication with Garden Reach, than that through the Kidderpoor Bazar, I take the liberty of offering the remark, that if this Bridge was in the first place erected, it would considerably relieve that at Kidderpoor, and give greater freedom to the future operations in the latter quarter.

On the subject of clearing Tolly's Nullah, which forms the remaining part of the 9th Paragraph of the Resolution above quoted, it appears to me that it can only be successfully effected by the operation of dredging, an operation which with local reference to the lower part of Bengal, offers, on a speculative examination, so many advantages over the present practice of Canal digging, that I cannot refrain from requesting the earnest attention of the Committee to the subject.

Impressed with an idea of the advantages to be derived from this mode of excavation in Bengal, I brought them to the notice of Government in August last, at the same time requesting to be allowed to purchase a Steam Engine, and adapt a Dredging apparatus and boat to it. Government was pleased to sanction my request, but owing to the delay that has taken place in fitting up the engine, I have not yet practically ascertained its power. The expense of Steam Dredging Machines will of course preclude their general employment in works of a temporary nature, like those under the control of the Committee, but that a considerable saving in manual labour in excavating the proposed Canals will result from the employment of these Machines, even if worked by men, is evident, on considering that in Tank or Canal digging, the number of hands employed on actual digging and filling the baskets, according to the present mode, bears but a small proportion to those engaged in removing the earth in the Dredging boats; only the first class of labourers will be necessary

the excavated earth being removed in a boat so constructed, that the earth may be dropped through the bottom in a deep part of the Channel. This operation will therefore be admirably adapted to the intended excavations, which are for the most part situated in the vicinity of deep rivers.

Dredging Machines might be employed with peculiar advantage in the Salt Water Lake, the Koosrie Khaul, and the Deacol Canal, which passes through an extensive morass, and in widening and deepening the Bytagatta Canal.

They could also be employed generally on all the Canals after a certain progress has been effected by the usual mode, and by a slight variation in their construction, might even be made to excavate a Canal from the beginning, where it is not required to be of any great length. Of this description, are the Cheltabaria, Narolee, and Nusserpoor Canals. Mr. May, the Supervisor of Nuddea Rivers, has lately made a trial with a Dredging Machine worked by hand, which he informed me answered his fullest expectation. As to the quantity of earth it lifted in a given time, owing however to his anxiety to put the machine at work on the Matabangah River, no exact calculation of the expense of its operations could at all times be ascertained.

The importance of reducing manual labour to the lowest scale, in the extensive works now under the superintendence of the Committee, will fully warrant a trial of the power of Dredging Machines on the above principle; and I earnestly hope the Committee will take advantage of the season of inactivity, to put them to the test. The expense of constructing the boat and apparatus, supposing the boat to be built of good Saul timber, which is sufficiently durable for the purpose, and coppered, will not probably exceed 4,000 Rs., and if begun immediately, might be completed during the rainy season.

I have the honor to be, &c.

(Signed) J. A. SCHALCH, *Superintendent of Canals
and Agent for the preparation of Suspension Bridges.*

CALCUTTA,
19th May, 1823.

No. 9.

No. 17.

To H. MACKENZIE, ESQ.

Secretary to Government, Territorial Department.

SIR,

The preliminary arrangements for the purchase of the Lands required for the projected Canal, from the Baliaghaut Canal to the Hoogly River, above Chitpoor, having been entered into by the Committee, I have the honor, by their desire to request, you will bring to the notice of the Honorable the Governor General in Council the following Plan of Procedure proposed to be adopted by them.

2. The line of the Canal on a width of 400 feet, from the Eastern Canal to Chitpoor, has already been determined upon, on an inspection of the Survey prepared by Lieutenant Schalch, and it has been resolved, that the progress of the purchases between given points, should be regulated in Committee, after which the Native Ameen is to proceed, under the guidance of the Secretary, to make preliminary arrangements with the several Proprietors for the purchase of the ground required.

3. These Preliminaries being settled, the Surveyor under Lieut. Schalch, is to fill up in the general Survey, the minute divisions of the several parcels of ground, for the Purchase of which, adjustment has been made, when, the name of the Proprietor, with a number corresponding with that in the Register of Purchases is to be entered on the Plan ; a copy of the Plan of each Division in which the Sub-divisional lines of demarcation of the Lands of the several Proprietors will be inserted, to be transmitted with the Secretary's Accounts of Purchases.

4. The Committee having thus satisfied themselves as to the Extent and Nature of the Premises about to be purchased, will direct the preparation of the Deeds of Conveyance, the Payment of the Purchase money, Possession to be taken of the Property, and the Preservation of the Title Deeds acquired.

5. These the Committee consider very material points, and that it is extremely desirable that the same practice and method with regard to them, should be observed in every case.

6. With regard to the preparation of the Deeds, few cases, the Committee imagine, will occur, in which it will be deemed necessary that they should be drawn, with the formalities of English Law. The usual Bynama, executed in the Native Languages, and confirmed by the delivery of the Title Deed of the Seller, will be, in the generality of cases, all that is requisite.

7. It will be the duty of the Ameen to report to the Committee any case of doubt or difficulty ; but with regard to others, the Committee think he may be safely trusted in judging of the simple validity of Title, with reference to the Customs and Usages of the 24-Pergunnabs, in which he was for many years Sherishtadar, in the Collector's Office.

8. Where the right to any premises about to be purchased, is contested, the publicity of the Committee's Proceedings, and the delay which will take place between the preliminary steps to the Purchase, and the actual Payment of the Purchase money, will allow ample time for the claimant to come forward and assert his claim, which will be enquired into by the Committee, who conclude, that the Legislature enactment about to be put in force, will make a provision for the adjustment of cases, where the parties may not be disposed to enter into an amicable adjustment.

9. With respect to the Payment of the Purchase money, the Committee suggest, that having obtained a Credit on the General Treasury, the Secretary should grant a Draft on the Sub-Treasurer to each Proprietor, the cost of whose lands and premises generally, shall exceed the sum of Sicca Rupees Two Thousand, (Sa. Rs. 2,000.) To Under Proprietors from whom purchases are made, to an amount below the above sum, payment shall be made by the Secretary, who will draw for the total amount required to discharge their several claims.

10. In all cases the Drafts of the Secretary, or those granted by him, shall be countersigned by two of the Members of the Committee. A Register of all Drafts to be kept by the Secretary, to be submitted to the Committee at all Meetings, when it will receive the counter-signature of the Members present, and a copy be forwarded with the Account and half yearly Reports to Government.

11. No Draft will be delivered to the Proprietors, or sums paid, until a full adjustment of the Purchase has been made.

12. This appears to the Committee the safest, and simplest plan. It will obviate the necessity of having any large sums in deposit, or the alternative of making frequent applications to Government for advances.

13. The taking possession of premises purchased, should be done in the customary form.

14. A Chowekedar to be placed on the ground, and measures immediately adopted by the Secretary for clearing it, who will render to the Committee the accounts of all expenses incurred for this purpose.

15. With respect to the Title Deeds, they should be regularly numbered, attested by the Secretary, in the presence of the Committee, tied up in a Nuttee with a Firhist, and kept in his office. Eventually it will be desirable, that they should be deposited in the Record Office of the Collector of the 24-Pergunnahs; but until the resales of the ground are concluded, it will be most convenient that they should remain in the keeping of the Secretary, as any confusion, or irregularity in the preservation of the Records of our Purchases and Sales, may be hereafter attended with considerable embarrassment to the Committee.

16. For this purpose, the Committee beg to suggest to Government the necessity for their employing a Record Keeper, on a salary of Sicca Rupees Thirty (Sa. Rs. 30) per month, and a Mohurier on Twenty Rs. (Sa. Rs. 20,) acquainted with the Bengallee and Persian Languages, for the due preservation of the Records, and for keeping up the several Registers of Sale, and Purchase—duties that we cannot expect the Ameen to fulfil satisfactorily without such assistance. When the whole of the Purchases and Resales have been effected, the Committee propose to make over all the Documents to the Collector of the 24-Pergunnahs.

17. To enable the Committee to close the purchase of such lands and premises, for which preliminary arrangements have been made, and to carry on their future purchases, they request you will obtain from Government, a credit in their favor on the General Treasury, for the sum of Sicca Rupees Two Lacs, to be drawn for in the manner already stated.

I have the honor to be,

Sir,

Your most obedient Servant,

J. N. JACKSON, *Captain,*

Secretary Canal Committee.

CALCUTTA,
10th June, 1823.

No. 10.

No. 522.

To CAPTAIN J. N. JACKSON,

Territorial Department.

Secretary to the Canal Committee.

SIR,

I am directed by the Governor General in Council, to acknowledge the receipt of your letter, dated the 27th ultimo, with its enclosures.

2. The Governor General in Council remarks, that whatever is done for the improvement of the Navigation of Tolly's Nullah, must now be done with reference to the Canal to Channel Creek. No separate Report is therefore required, and the appointment of Lieut. Schalch to Survey the Nullah, under the Orders of the 8th February 1822, is to be considered as having merged in his latter appointment of Superintendent of Canals.

I am, &c.

Your most obedient Servant,

(Signed)

HOLT MACKENZIE,

Secretary to Government.

COUNCIL CHAMBER,
The 12th June, 1823.

No. 19.

(Copy.)

TO CAPTAIN JACKSON,

Assistant Quarter Master General, Secretary to the Canal Committee.

SIR,

Having been engaged for some time past in making enquiries as to the rates of labour, in Tank and Canal digging, and also in clearing the Jungle at different places along the line of the proposed Canals, together with other subjects connected with their excavation, I have now the honor of sending the result of my enquiries to the Committee, and of offering a few suggestions that have arisen out of them, which will I trust, meet with the approbation and sanction of the Committee.

2. It appears that the wages given by the Zeemeendars to Tank Diggers, varies in different parts of the line, from $\frac{3}{8}$ to $\frac{3}{12}$ and 4 Rs. and that to every thousand men so employed, an allowance is demanded for Sirdars and Mates, varying in number from 4 to 7 of the former, and 5 to 10 of the latter, and in pay, from 5 to $\frac{7}{8}$ for the former.—The pay of the latter seems to be very generally fixed at 4 Rupees.

3. These rates were ascertained by Lieutenant Prinsep in his late visit to the Sunderbunds, and they agree with those at which the Sirdars, and other Natives, whose employment lies in furnishing Coolies, have offered to supply them.

4. As the difference in the rates of labour does not arise so much from the situation of the place as from the difference in the demands of the Sirdars, it appears to me, therefore, that it would be advisable to establish a fixed rate of hire, viz. $\frac{3}{12}$ for Labourers, 6 Rs. for Sirdars, and 4 for Mates, with an allowance of 6 Sirdars and 10 Mates to 1,000 Labourers. This is about the mean of the numerous rates with which I have been supplied, and which will, I am led to believe, be sufficiently high to ensure the required number of Labourers.

5. I have already received offers to clear Jungle at the above mentioned rates.

6. From what I can collect, I do not apprehend any scarcity of hands from Labourers engaging to make Salt in preference to working on the Canals, as it appears, those available for the latter employment, will be drawn from Villages lying to the North of the Salt Districts. It is doubtful as yet if it will be necessary to raise the pay of the Labourers during the harvest season, in November and December.

7. It is calculated that 2,500 men will excavate one mile of the Canal in one month. The length of Canal to be excavated between Culna and the Salt Lake is as follows, nearly :—

Nuggerpoor Canal,	$1\frac{1}{2}$ miles.
Narolee Ditto,	$\frac{1}{2}$
Sireepoor Ditto,	9
Husseinabad Ditto,	9
Cheltabaria Ditto,	$3\frac{1}{2}$
Baminghatta Ditto,	5

Total $28\frac{1}{2}$

Now supposing it practicable to commence excavating these Canals in December, (and I see nothing at present to lead to a doubt of the practicability of doing so,) there will still remain six months of the most favorable part of the year for Canal operations, to complete therefore the whole length of excavation between Culna and the Salt Lake,

it will be necessary to employ 11,884 Labourers, which will involve a monthly expenditure of Sa. Rs. 48,404, or the expense of Workmen for the season will amount to Sa. Rs. 2,90,424.

8. I do not apprehend any difficulty in procuring the above number of hands, as I have already received Tenders from Sirdars to supply a far greater number.

9. In the above Estimate, I have not included the men that will be required for the Circular Road Canal, as there is little hope of being able to commence it this Season, from the stoppage that has taken place in the purchase of land.

10. It appears, that an advance of 2 Rs. for each man is demanded by (and is usually given to) the Sirdars, fifteen or thirty days before the men are required, according to the distance from which they are to be collected. It also appears, that it will be necessary to make the required advances and payments at different places along the line. Those which at present seem to be the most suitable are Baugundee and Narolee; a Cash-keeper with his Mohurir will consequently be required at each of these places, as also a Guard of Sepoys. The sum it will be necessary to keep in hand at Baugundee and Narolee, in order to insure the prompt payment of the Labourer's wages, should not be less than the probable amount of one month's disbursement, or Sa. Rs. 50,000 in round numbers.

11. At Baugundee, a Jemadar's party would perhaps be sufficiently strong to guard the money deposited there, as it would also be assisted by the Guard of the Salt Agency, at Narolee. As the amount of cash will never exceed 12,000 Rs. a Havildar's party may be thought a sufficient guard for such a sum.

12. While on the subject of Sepoy Guards, I beg leave to remark, that a guard will be required to protect the men employed in clearing the Jungle between Husseinabad and Bussera, from Tigers, and also during the time the Labourers are at work on the Canals. A Jemadar's party, with a few Shikarees, would be sufficient. The number of men therefore that it will be necessary to apply for, will be 72 Sepoys, with the usual proportion of Native Officers and Camp Equipage.

13. As I have already engaged a number of Woodcutters to be in readiness at Husseinabad, by the 15th of November, in order that no delay may take place in marking out the direction of this Canal, I beg the Committee will make an early application to Government for the Sepoys to protect them.

14. It is of very material consequence to the success of the operations in this quarter, that few casualties should take place from Tigers, particularly at the commencement of the work, as they would undoubtedly operate, either to a total abandonment of this part of the scheme, or to increase the rates of labour to an exorbitant degree, not only on this, but on all the other Canals. Much time would probably be saved in procuring the Guard, if it were drawn from the Calcutta Native Militia, the men of which corps will not be so subject to sickness in the Sunderbund districts as Sepoys from the regular Regiments.

15. I also take the liberty of suggesting to the Committee, the propriety of taking measures to secure to Government, the right of the land cleared on each side of the Canals that now pass through Jungle, which, without some precaution of this nature, would at a future period be claimed by those Zeemeendars, whose Estates lie in the neighbourhood of the line, and who will carry their cultivation up to it as soon as the Canals shall be opened. The Zeemeendars have, I believe at present, no Proprietary right in uncleared Sunderbund Tracts; by placing a broad belt on each side of the Canals in the hands of Government, its cultivation could always be secured, which is of material consequence to the future safe navigation of them.

Sic in Original
J. M.

16. As the European Overseers, and the parties of Labourers will be constantly moving as the work is in progress, I take the liberty of recommending, that tents be substituted in

lieu of temporary Bungalows for the European Overseers, the expense will be about the same; but the former will be far more convenient. The description of tent that would be required is that used by European Serjeants; these I could get made up by the Commissariat Agent for 185 Rs. each.

17. I also take this opportunity of stating to the Committee, that it will probably be requisite to establish Bazzars, when the working parties are at a distance from the Haths and regular Bazzars of the District. During the time the Jungle is clearing, it will also be necessary to engage a few Boats for the Woodcutters to sleep in.

18. I take the liberty of calling the attention of the Committee to the serious consequences that will result, in the employment of so great a number of Labourers, from delay in the payment of their wages, or from a deficiency of hands during the working season, and beg that the Committee will have at its disposal for the ensuing season, a sum not less than Sa. Rs. 3,00,000, or three Lacks, to ensure the prompt payment of such advances as it may be necessary to make from time to time.

19. Considering the amount of the contemplated expenditure, and the numerous detailed accounts that will attend it, I beg I may be allowed an Accountant, on such a salary as the Committee may think sufficiently liberal to insure the services of a man of respectability. I also request, that my Assistant, Lieut. Prinsep, may be allowed the same.

20. As the work proceeds, I shall inform the Committee of the number of Writers that may be necessary; at present, the one already allowed me is sufficient.

I have the honor to be,

Sir,

Your obedient Servant,

(Signed) J. AUG. SCHALCH,
Superintendent of Canals, &c.

CALCUTTA,
6th October, 1823.

A true Copy,

J. JACKSON, *Captain,*
Secretary to the Canal Committee.

No. 27.

To W. PATON,
H. SHAKESPEAR,
C. BARWELL, AND
CAPT. W. SWINTON, } ESQRS.

Committee for Reporting on Lt. Schaleh's Plans.

Revenue, the 30th July, 1824.

GENTLEMEN,

I am directed to inform you, that the Governor General in Council has resolved that all Public Works, likely to occasion any considerable Disbursement, and which are not of indispensable necessity, or such as that the discontinuance of them would be seriously detrimental, shall for the present be suspended, and with reference to that Resolution to communicate to you as follows:—

2. The Channel Creek and Diamond Harbour Canal has not, it is understood, yet been commenced on: and His Lordship in Council has determined, therefore, that all measures towards the completion of it shall be postponed until further orders. It is not,

however, intended to delay the completion of the Suspension Bridge over Tolly's Nullah at Kidderpore, authorized by the Orders of Government of the 17th July 1823; that work appearing to be urgently required.

3. It further appears to the Governor General in Council, that the further prosecution of the Canal from Calcutta to Culna ought for the present to be suspended, though His Lordship in Council is of course fully sensible of the general inconvenience incident to any delay in the completion of so useful a work. Before, however, passing any final orders on this subject, His Lordship in Council desires to receive from you, (and you are requested to furnish it as soon as possible,) a succinct account of what has been done; whether in the purchase of Ground, the excavation of the Canal, or in any other works connected with the progress of the undertaking, with a communication of your sentiments in regard to the course most expedient to be followed under the Resolution stated at the commencement of this letter. You will of course immediately consider and report what reduction of Establishment can be made, (whether in the Canal or Suspension Bridge Department,) on the supposition, first, that the further prosecution of the Canals is entirely suspended; and, secondly, that the works are only partially discontinued, if the latter course shall appear to you most proper.

I have, &c.

[*Secretary to Govt.*]

No. 27. a

No. 868.

Extract from the Proceedings of the Right Honorable the Governor General in Council, in the Territorial Department, under date the 23rd July, 1824.

RESOLUTION.—The Governor General in Council observes, that since the sketch Estimate of the Receipts and Disbursements of the current year 1824-25 was prepared, several arrangements and measures, calculated materially to increase the public charges, have been adopted, and the state of the Cash Balances, and the various external demands, which have to be met within the year, render it essentially important, that the financial Officers of Government should be informed as early and accurately as possible of the probable extent of the charges, consequent on the War with the Burmese, which will have to be incurred within the period in question, in order that they may without delay enter on a consideration of the sufficiency of our means for the unembarrassed conduct of the Public Service, and of the arrangements to be adopted for supplying the requisite funds.

2. Resolved accordingly,—That there be prepared in the Military and Secret Departments, as accurate Estimates as practicable, of the probable amount of the War Charges which have been incurred, and are likely to be incurred, in the course of the current year.

3. The Governor General in Council is further pleased to resolve, with reference to the present state of things, that all Public Works, likely to occasion any considerable Disbursement, and which are not of indispensable necessity, or such as that the discontinuance of them would be seriously detrimental, shall for the present be suspended. The practical application of this Resolution will be further considered in the several Departments, in communication with the Boards and Committees whom it concerns.

Ordered,—That a Copy of the above Resolution be sent to the Military and Secret Department, whence immediate measures will be taken to prepare and transmit to this Department, Estimates, as specified in the 2d paragraph : from the former, of the charges incident to arrangements which have been actually authorized in the Military ; and from the latter, of those likely to result from measures and operations ordered or contemplated in the Political Department.

Ordered also,—That a Copy of the same Resolution be also sent to the Judicial Department, for the purpose specified in the 3rd paragraph. For the same purpose, a Copy of the Resolution will be transferred to the Revenue branch of the Territorial Department.

(A true Extract,)

HOLT MACKENZIE,

Secretary to the Government.

No. 28.

(Copy.)

TO LIEUTENANT GARDEN,

Officiating Secretary to the Canal Committee.

SIR,

In reply to your letter of the 6th ultimo, I now do myself the honor of forwarding to the Committee, a Statement of the present condition of the Public Works under my superintendence, taking them for the sake of perspicuity in the following order :—

1st. The Iron Bridges.

2nd. The Canals.

2. Of the Bridges, the two for the Goreekal and Kuddamkundee Nullahs on the Cuttack Road have been finished, and packed up preparatory to being shipped to their destinations. They have been temporarily fixed up in the Yard, and every part so fitted together and marked, as to render their final adjustment a matter of easy accomplishment. A report of their completion has been sent to the Military Board.

3. I request the Committee will recommend to Government, that the Bridges be forwarded without delay to Balasore, in order that the present favorable season for their erection may not be lost. The iron and wood work have been prepared at a considerable expense, and the Masonry of the piers of one of the Bridges has, I understand, been completed. By delaying to erect the Bridges, the wood work must be renewed, and a further expense incurred, in refitting the iron work, and replacing the marks of reference, which in a few months will become illegible.

4. An accurate Survey and Sections have been taken of the Currumnassa River, where it intersects the New Road from Calcutta to Benares, preparatory to forming a plan for a Bridge, which is now under consideration.

5th. A plan for a Bridge over the Soombah Nullah, which crosses the Road between Benares and the Cantonment of Sultanpoor, was delivered to the Military Board, with a request, that it might be forwarded to the Barrack-master at Benares for his opinion and estimate on certain points connected with the Masonry. A reply from the Military Board has not yet been received.

6th. Plans of Bridges for the Soondie and Teel Nullahs, near the station of Chuprah, are now in progress, founded upon the Sections of the Nullahs taken by my Assistant, Captain Baker, when on his way to join my department from the Upper Provinces.

7th. The Kidderpoor Bridge is in a considerable state of forwardness. The difficulty of erecting the Rivetment Walls on a foundation extremely unfavorable, has been overcome, and the Masonry has stood the effects of the rainy season, without exhibiting any appearance of weakness.

8th. The soil on which the foundation of the Rivetment Walls were to be built, was discovered on digging to consist wholly of a loose quicksand, which opposed a difficulty to their construction, at first sight insurmountable. By sinking, however, rows of piles, and connecting them by planks, the interior space was excavated, with much labour, to the required depth; other piles were then driven, and the foundations raised thereon.

9th. Although extremely expensive, the above mode of proceeding was absolutely indispensable to the security of the Masonry, to which it was also found necessary to give a greater breadth.

10th. It was my intention, on discovering the extra expense to which the work was liable, from the above-mentioned cause, to have suspended operations, and brought the subject to the notice of Government. The near approach, however, of the rainy season, and the insecurity of the upper ground behind the Rivetment Walls, which, had it given way in the slightest degree, would not only have rendered the construction of the Iron Bridge impracticable, but would have endangered the present one, made the unremitting prosecution of the work absolutely necessary. The Estimate for the walls in my letter of the 27th June 1823, is Sa. Rs. 3570, whereas the actual expense, according to the bills forwarded to the Committee, amounts to Rs. 9187 for the Masonry, and 6111 Rs. for the Embankment made to keep out the Tide during the work.

11. In reviewing the expenditure thus incurred, I beg it may be considered, that three unsuccessful attempts have been made at different times, and by different individuals, to erect a mass of Masonry on the banks of the Nullah, at or near the spot I selected, and I trust, that when the obstacles that have been surmounted shall be duly considered, the expense of the work will not be deemed extravagant.

12. The greater portion of the Chains are finished, and as soon as Government shall have decided on the expediency of adopting the improvement of the original plan of the Road Ways, which I had lately the honor of laying before the Committee, the construction of the Piers will proceed rapidly. The very decayed state of the present Kidderpoor Bridge, which has suffered fresh dilapidation from the late rains, more particularly on the Southern side, renders the speedy construction of the New Bridge extremely urgent.

13. I have given Captain Baker, my Assistant in this branch of my Department, directions for his guidance for the construction of the Bridge, and shall continue to do so until I leave the Presidency. I request, however, as Captain Baker has taken charge of the Yard, that from the 1st instant, the accounts of the Bridge Department may be transferred to him, and submitted in his name, and on his responsibility, during my absence with the Army.

14. With regard to the diminution of the Establishment employed in this Department, I beg leave to submit, that it is at present on a scale, that could not be diminished without greatly impeding the progress of the works. It consists of

- 1 Uncovenanted Assistant,
- 2 Overseers,
- 1 Sirkar,
- 3 Writers.

The Apprentices I had the permission of Government to select from some of the Schools in Calcutta, have not as yet been borne on the strength of the Department.

15. A heavy expense, consequent on all new establishments of a similar description, has hitherto attended this, in the construction of Buildings, and the purchases and manufacture of Tools. This will now in a great measure cease, as a convenient Yard and Workshops have

been established, and stock of tools and materials laid in sufficient, with but a few additions from time to time, for the future use of the Yard.

16. Before concluding this part of my Report, I request the indulgence of the Committee to a few brief observations on the Establishment, which, although in its commencement may be said to have received the test of experiment, and to have realized in some measure the favorable hopes that were entertained of its utility.

17. The principal object of introducing Iron Suspension Bridges into India, was to avoid the heavy expense attending the construction of Bridges of Masonry, and by reducing the expense of these structures, to improve the communication by land generally throughout the Country.

18. That Bridges on the Suspension principle may be erected at a moderate cost, which may be defrayed in a short period by the imposition of a light Toll on passengers, I have already shewn in my report on the completion of the Kallyghaut Bridge, which would, by this time, have doubly repaid the expense of its construction, by the levy of a Toll equal only to that of the Ferry it has supplanted.

19. The two Bridges for the Nullahs on the Cuttack Road have been completed at an expense of less than 12,000 Rs. each, and have consequently further proved the economy of this description of Bridge.

20. To have constructed over the Nullahs in question, Bridges of brick Masonry, with a water way equal to that of the Iron Bridges, which is essentially necessary, as I have explained in my report of the examination of these streams, would have been attended with an expense of probably not less than a Lack and a half of Rupees each.

21. That these Bridges may be considered of a durable nature, and not requiring frequent repair has been ascertained from the fact, that after a minute examination, the iron work of the Ballyghaut Bridge was found not to have suffered any injury, either from the weather or from wear, during a period now of nearly two years. It has received no other attention than a coat of coal tar, the cost of which amounted to only eleven Rupees.

22. I would, however, suggest the expediency of a report being sent to me annually on the 1st of January, from the local officers under whose Superintendence the Bridges are placed, stating the condition of the iron and wood work, and that they have received the usual annual coating of coal tar, which is all that is required to preserve the iron from rust.

23. The substitution of iron for wooden beams in the Road Way, which I have from experiment found to be practicable, will render Bridges of this description little or not at all inferior to those of brick Masonry; nor will they be subjected to a heavier expense in repairs, the latter generally requiring repairs every second or third year, from the injury they usually receive in the rainy season by the overflowing of the stream, in consequence of the contracted span with which arches of brick Masonry must necessarily be built.

24. Considering, therefore, the economy and durability of Iron Bridges on the Suspension principle, their peculiar applicability to India, and the facility of defraying their expense by the levy of a Toll so light, and for so short a period, that it would not be oppressively felt by the population, their utility to Government by keeping open a Military communication throughout the country at all seasons of the year, and the indirect advantages that will arise from an increased cultivation and commerce, which has ever been found to follow a free communication and easy transport of produce, and the blessings such structures are to the inhabitants of a country generally, I trust the Committee will urge the support of Government to this useful establishment.

25. No measure would tend so materially to its prosperity as its constant employment. The difficulty of instructing workmen, and proving or correcting theory by practical observation, has now in a great measure been removed; certainty in construction has taken place of conjecture, and a regularity and exactness of work has been acquired by continued

and long established practice ; to suspend its operations would at once destroy the establishment, by relinquishing the advantages that have been attained, and I therefore humbly suggest, that on the completion of the Kidderpoor Bridge, some one of those now under consideration may be commenced.

26. A quantity of materials having been collected, the expense of the construction of Bridges will for sometime be light and gradual. Bridges for the Caramnassa River and the Soombah Nullah, have long been urgently desired, and although the want has been partially and temporarily supplied by a Rope Bridge at the former, the destructible nature of the material will soon render necessary a more permanant structure.

Canals.

27. The Canal operations upon which I have been engaged are the following :—

- 1st. Affording instruction to Mr. Schultz in the excavation of the Chooramonee Canal.
- 2d. Surveying and Levelling the Country between Channel Creek and Calcutta.
- 3d. Clearing the head of the Eastern or Balliaghaut Canal, and erecting a Bridge over it at Kooliah, under the Orders of Government of 27th February 1823.
- 4th. Forming Embankments through the Salt Water Lake, under the same authority.
- 5th. Conducting the progress of the Great Eastern Canal.

Chooramonee Canal.

28.—

- 1st. This Canal is chiefly under the control of the Commissioner of Cuttack, with whom Mr. Schultz, the Executive Officer, corresponds. I have, however, furnished him with Plans and Instructions for his guidance. The rate of expense at which he is conducting his work appears to be exceedingly moderate, but his progress is slow, from causes which I understand he has more fully explained to Government through the Commissioner of Cuttack.

Diamond Harbour Canal.

29.—

- 2ndly. The progress made with this Canal, is a minute Survey of the Country with accurate Levels from the Hoogly River at Kidderpoor to Rangafulla, with observations and comparisons of the rise and fall of the Tide at Diamond Harbour and Calcutta. An inspection of the accompanying Maps* and Memoir, prepared by Captain Taylor, will shew the care with which the several operations have been conducted. The Levelling of so great a distance as that between Chandpaul Ghaut and Diamond Harbour, where the accuracy of each day's work was proved by releveing, was necessarily a tedious and laborious, although an indispensable, operation. Capt. Taylor has, however, conducted it with much skill and assiduity, through a country generally unfavorable, and has collected information, which combined, with what I already possess, is sufficient for com-

Captain Taylor's Maps.
 * General Map.
 Survey of Tolly's Nullah and the Sulloory. }
 Survey of the Diamond Harbour Creek. }
 Survey of the Chingree Creek. }
 Survey of the bank of the River Hoogly from the Chingree Creek to Rangafulla. }
 Survey of the old Road, Ditches and Nullah, between Oostee and Hotogunge. }
 Survey and levelling section of the line of country between Rainapookreeh and Oostee. }

mencing immediately on the Canal, whenever Government may order it to be undertaken.

30. Conceiving it not to be the wish of the Committee to enter at present on the details of this Canal, from its progress having been temporarily suspended by Government,

I shall confine myself to the observation, that the Surveys and Levels coincide with, and corroborate in a remarkable degree those originally laid before Government by me, and shew in the clearest manner, that no natural obstacles exist to a successful accomplishment of the Scheme, and at an Expense somewhat less than the Original Estimate of 5 Lacks.

Ballighaut Canal.

31.—

3rdly. From the advanced season of the year at which I received the order of Government to clear the head of the Ballighaut Canal, I found it necessary to delay the operation until the close of the rains; a distance of 3,320 feet from the head of the Canal to the Bridge has been excavated to a depth of $4\frac{1}{2}$ feet, and an average breadth of 65 feet, the cost of which has amounted to 4,436 Rs. and 12 Annas, being 982 Rs. and 12 Annas in excess of the Estimate. The work, however, has been performed at the rate of $6\frac{1}{2}$ Annas per 100 cubic feet, being nearly half the rate at which Mr. Siret offered to undertake it in his Estimate forwarded to Government by Mr. Trower, Collector of the 24-Pergunnahs, in his letter under date 28th January 1823.

32. The broken brick arch of the Kooleah Bridge has been removed, and on the piers one of wood substituted, the expense amounts to Sa. Rs. 1,530 : 1 : 8, which exceeds the estimate by 530 : 1 : 8, in consequence of the difficulty and labour of removing the old brick work, and of erecting a temporary Bridge across the Nullah during the time the work was in progress.

Salt Water Lake.

33.—

4th. Owing to the very slimy nature of the soil in the Salt Water Lake, I found myself obliged to relinquish the formation of the Embankments through it until Dredging Boats could be prepared. Embankments have been, however, carried out a considerable distance into the Lake from the extremity of the Ballighaut Canal, and the anticipated effects of the Tide in the Canal, as stated in the 4th paragraph of my letter to Mr. Holt Mackenzie, dated 5th April 1823, were partially visible.

34. The expense of the Embankments amounts to only Sa. Rs. 1451 : 7 : 6. By the use of Dredging Boats, I have every reason to believe, that the eventual expense of the Bunds through the Lake, will not exceed the Original Estimate stated in the above mentioned letter.

Great Eastern Canal.

35.—

h two Maps.

5th. The operations on this Canal, with the exception of the purchase of Land in the vicinity of Calcutta, have been confined to the Excavation of two Cuts in the neighbourhood of Hosseinabad on the Jubunah River, and to clearing Jungle along the Chowmoon Khaul, the formation of Bunds, and clearing Jungle on the banks of the Dassar Khaul, which connects the Bayley Gunge and Hosseinabad Canals, and the Survey of the Country between Deacol and Hosseinabad.

36. The accompanying Plan, No. 1, shews the extent of Excavation of the Cuts above-mentioned, amounting to 11,259 running feet, or to a length of upwards of two miles.

37. It will be observable, however, that from having taken advantage of that part of the Dassar Khaul, which lies in a favorable direction, upwards of 5,000 feet of natural Navigation have been acquired. The whole extent Excavation, therefore, to complete the com-

munication between the Juboonah River at Hosseinabad, and the Chowmooah, which leads to Bussera, will be eight miles, three of which are nearly completed.

38. The expense attending the Operations of the Season, has been much greater than was originally contemplated. A Statement of my Proceedings from the Commencement of the Season, will render more intelligible the explanation I have to offer on this head.

39. During the Rains preceding the commencement of the Excavation, I was engaged in taking measures for the supply of Labourers. For this purpose, I dispatched some old inhabitants of the country in the vicinity of Baugundee, to collect information as to the number procurable, and from the reports I received, I expected to have been able to place 11,000 men at work, and it was with this anticipation I addressed a Letter to the Committee, under date the 6th of October last, wherein I stated the hope of commencing on the whole of the Canals at the same time; on proceeding to Baugundee however, I found so many of the Securities of the Contracting Sirdars objectionable, that the number of men for whom advances were given, was reduced to 3,800 for digging the Canals, and 800 for clearing Jungle.

40. By the 27th of November, 37 men were collected for clearing Jungle, and by the end of December, the number was increased to only 191 men. On the 16th of December, 230 men were placed on the Excavation, and by the end of the same month, only 1891 were procurable; and throughout the season the number of Labourers never exceeded 300 daily for clearing Jungle, and 2,000 for digging.

41. With the number of Labourers above mentioned, I commenced clearing the Jungle, for the Canal on the 27th of November, under circumstances very discouraging. The preceding rainy season was one of the most severe ever experienced in India, the ground through which the course of the Canal was to be carried, had been so long in a state of inundation, that the Labourers sunk over their knees in mud at every step. In this manner two miles of Jungle were penetrated.

42. The same cause also operated to impede the progress of the Excavations, the upper stratum of the soil being in so fluid a state, that it was with difficulty removed.

43. To shew the *ignorance* of the natives in the part of the country where we were engaged in the work on which they were employed, it may be observed, that when first the Excavations commenced, I found that the parties of 8 men, into which the whole were divided, dug during a day, no greater quantity than 9 feet square by 2 deep, or 162 cubic feet, notwithstanding every exertion on the part of the Overseers, my Assistant, and myself; the expense of the Calcutta Chouka, or 729 cubic feet, at this rate, amounted to no less than 4 Rs. and 8 Annas. I consequently requested and obtained the sanction of the Committee to enter upon contract engagements, and abolish the system of Day Labourers; after some hesitation, the Sirdars accepted contracts on the following terms; viz. 1 Rupee and 10 Annas per Calcutta Chouka in cultivated or cleared Ground; 1 Rupee and 14 Annas in Jungle land, at which rate the Canal has subsequently been excavated, or at an expense of 9,720 Rs. the mile, or within the Original Estimate of 10,000. Rs. the mile.

44. I also found at first a great aversion on the part of the natives to engage in clearing the Jungle, our parties were frequently reduced to one-half their number by desertions in the course of the day, I consequently entered into contract for clearing Jungles at the rate of 3 Rs. and 8 Annas the Beegah, &c.; the greater portion of the land for the Canal has been cleared at this rate. It exceeds the Estimate by 1 R. and 8 Annas the Beegah, but as the whole expense of clearing Jungle is only estimated at 1281 Rs. the excess in this item of expense will be inconsiderable.

45. Making tracking paths along the existing Nullahs, which are to form a part of the line of navigation, has been found more expensive than was at first contemplated, owing to the

soft pulpy nature of the upper stratum of the soil, as before noticed, which it was found necessary to remove to obtain earth of a sufficient degree of consistency to withstand the effects of inundation.

46. I have now I believe briefly enumerated the principal points of my executive operations, to which obstacles and difficulties were presented of no common description, these have, however, been happily overcome, nor are they likely to recur at a future period. The part I commenced on is the most difficult of the whole line, it is the only part wholly conducted through Jungle, at a distance from villages and fresh water. Perhaps I acted wrong in selecting it for the commencement of my work. Had I chosen a cultivated tract, my progress would have been more apparent, but as that I selected was the only one of which I had any doubts of success, I was anxious to be satisfied of the practicability of forming a Canal through it before the others were undertaken.

47. The chief cause therefore of the excess of expence of the Excavations beyond what was originally contemplated, may be looked for in the ignorance of the Labourers in the manner of conducting the work at its commencement, and in the natural difficulties of the country; yet before the close of the season, I have shewn in a former paragraph, that the expense was reduced within the Original Estimate, nor have I any reason for supposing it will in future exceed it.

48. In conformity with the instructions conveyed in the 2d paragraph of your letter, and after a most mature consideration of the subject, I now beg leave humbly to submit to the Committee my opinion, that the success of the Canals in question will be endangered by a present cessation of their progress. In a work of such magnitude, nothing less than unremitted exertion can possibly bring it to a successful close. Considerable progress, and that of the most desirable nature, has been made, in acquiring a thorough knowledge from practice (the only way of obtaining it) of the true manner of conducting the work, and in making it perfectly understood to the people generally, to whom its execution must be entrusted. To suspend its progress, would be to forego the advantages already acquired. The term of life in India is precarious, and when it is considered that the ground-work upon which the Undertaking is now proceeding, is the accumulated information of ten years of my own personal Survey and Observations in its minutest detail, the Committee will probably not regard this as the least among the present advantages, or of so little consideration as to be left to future contingency.

49. In the first paragraph of Mr. Holt Mackenzie's letter of the 30th July, the object of Government in wishing to suspend the work in question is stated to be, to "avoid any considerable disbursement in Works which are not of indispensable necessity." I shall now endeavour to shew, that the Work in question is more urgent and more indispensably necessary than when it originally received the sanction of Government, and that it may be conducted for sometime to come in a manner that will cause no considerable expenditure.

50. At the period the plan of the Canals in question was laid before Government, in August 1822, of the three principal communications between the Ganges and the Hoogly, the Baugretty and Matabanga passages were partially navigable, and it was confidently hoped by many, that by artificial means, they might be maintained so throughout succeeding years. Experience has, however, now fully proved, what was strongly urged in my original Memoir, the impossibility of keeping their Channels open by artificial means, or of controlling the enormous quantity of sand that is annually poured into them from the Ganges, although since the above mentioned period, various attempts have been made to accomplish so desirable an object. During the late Dry Season, both the Baugretty and Matabangah were wholly unnavigable, whilst the Jellinghee, which I had myself observed

in 1821, completely obstructed by sand, remained open for a short time after the rains of 1823, when it became unnavigable, to the great distress of the Inland Trade, and the only passage that then remained to Calcutta, was through the Sunderbunds and Tolly's Nullah, the inconveniences of which, whilst they indicate the necessity of the present Canal, have been so fully brought at various times to the notice of Government, as to render any remarks here unnecessary.

51. I shall now proceed to lay down for the consideration of the Committee, a plan for the future execution of the work, which, combining the utmost economy of which it can be susceptible with dispatch, will at the same time be found to embrace the objects of Government, as stated above. I have before shewn, that the most economical and surest mode of conducting the Excavation of the Canals, is by contract engagements for specific work, and it is evident, that it must be the most expeditious, as personal superintendence of its progress is required in a less degree than any other mode of working, and consequently, a greater quantity of work can be undertaken at the same time. I would therefore suggest, that the above arrangement be carried into effect by a minute survey of the line of Canal as a preliminary and indispensable measure, in the progress of which the ground to be excavated should be marked off and partitioned into lots, of an extent the most convenient for contractors, and that each lot should be distinctly defined by a boundary ditch. On the completion of this measure, or during the time it is going forward, contracts for the various lots might be received and registered, the respectability and means of securities ascertained, and such other necessary arrangements made, as would facilitate the progress of the Excavations whenever they may be undertaken.

52. Should Government accede to this suggestion, the immediate expenditure will be reduced to the personal Establishments of myself and Assistants, and to a few Labourers to work at and clear the ground for the purposes above mentioned,—the whole of the European and Native Establishment at present entertained may therefore be discharged, with the exception of the European Surveyor, Turner, to be placed under the Secretary to the Committee, to Survey the Estates purchased by them, and one Accountant and Writer, who will probably be found sufficient for the Office duties.

53. I have not as yet brought forward the outstanding balances of the Canal operations, the constant attendance in all works of a similar nature, whether conducted by Government or Individuals, such is the system now universally established throughout Bengal, that no work of any magnitude, like the one under consideration, can be performed without the agency of a set of individuals who are usually styled Sirdars, and to whom advances must previously be made, either for the supply of Labourers or for specific work. In the present instance, the Outstanding Balances amount to Rs. 14,844 : 9 : 5½. The reason of the balances being so heavy, is partly owing to my anxiety to push forward the Excavations, and partly to the necessity that existed of closing work by the end of May, from the great scarcity of fresh water, and consequent unhealthiness of the place, as I have before stated.

54. Should the Canal operations be continued, the contrary to which was never contemplated, the Outstanding Balances could be worked off by degrees in the ensuing season ; but if the work is closed, it will be necessary to resort to law to compel the securities to refund the advances the Contractors have received, a measure that will be attended with great distress to the individuals, and to a considerable portion of the population inhabiting the vicinity of the Canals, who have been engaged on the Excavations, and will I fear, create a feeling throughout the Country, greatly detrimental to the future progress of the work.

55. Legal measures for the recovery of the advances are, however, now in progress by the Superintendent of Law Suits, in whose hands the accounts have been placed.

56. As the purchase of the land for the Canal in the vicinity of Calcutta has rested exclusively with the Committee, I shall only observe, that the purchases already made, have I believe in every instance fallen short of the Estimate of 60 Rupees the Cottah.

I have the honor to be,

Sir,

Your obedient Servant,

CALCUTTA,
SUPT. OF CANALS' OFFICE,
19th October, 1824.

(Signed) J. AUG. SCHALCH, Major,
Superintendent of Canals, and Agent
for the preparation of Suspension Bridges.

P. S.—As the accompanying Maps are originals, I request they may be returned to my Office, after having been submitted to Government.

A true Copy,

CHARLES PATON,
Officiating Secretary Canal Committee.

No. 28. a

(Copy.)

To CAPTAIN J. A. SCHALCH,

Superintendent of Canals.

SIR,

Herewith I transmit the Maps and Surveys detailed in the margin, which were executed by me according to your instructions, with reference to the construction of the proposed Canal, to communicate with the New Anchorage, Diamond Harbour Creek, and Tolly's Nullah.

Though I hope the Surveyors themselves will afford the necessary information to enable you to mature your plans for the Canal, it may nevertheless be satisfactory to you to be put in possession of such remarks and observations as occurred to me in conducting the Survey, relating to the nature of the soil, supply of fresh Water, Population, and such other matters as are likely to come under discussion before the Canal Committee; but I regret that my ignorance of the Bengalee language, and the reluctance of the people themselves to afford information, operated to prevent me collecting much that would doubtless be of importance.

GENERAL MAP.
Survey of Tolly's Nullah and the Puttoory. }
Survey of the Diamond Harbour Creek. }
Survey of the Chingree Creek, }
Survey of the bank of the River Hoogly from the Chingree Creek to Rangafullah. }
Survey of the old Road }
Ditches and Nullah between Oostee, and Hoto-gunge. }
Survey and Levelling section of the line of Country between Keimapookreah and Oostee. }

Previous to commencing the Survey of the proposed line of the Canal, careful Survey with sections of Tolly's and the Puttoory Nullahs was made as high up the latter as Bagesie, and the difference of Level between Chandpaul Ghaut and the ledge of a Temple at Keimapookreah, was ascertained by a series of levels taken with the utmost care, and proved by levelling back; the former will enable you to form a judgment of how far the Nullahs may be made available in constructing the proposed Canal. Tolly's Nullah at low Water in April is nearly dry, and entirely so immediately above the confluence of the Puttoory. The Puttoory at the section G. H. has but a depth of five inches at Low Water, both I imagine

would scour out to the depth required on opening the Canal, if the earth was loosened by raking, or any other process ; but as the stuff thus removed would be carried by the reflux of the Tide into the River Hoogly, it will be a question for consideration, if danger would not be incurred thereby, of a sand bank forming below the mouth of Tolly's Nullah, which would prove injurious to the Navigation of the River. It may, however, be remarked, that no such tendency has yet appeared, though the banks of Tolly's Nullah are washing away in several places, and consequently much earth and sand must be carried down ; on the contrary, there is now a depth of 50 feet at Low Water immediately below the mouth of the Nullah, and close to the bank. Secondly, that the direction of the Reaches of the River Hoogly, both above and below the mouth of Tolly's Nullah being calculated to throw the force of the current on that point, or near it, both in the flux and reflux of the Tide, the formation of a sand bank at that particular place is very improbable, and could only occur by some operating cause, giving the current a different direction to that which it holds at present.

The Levels were taken from Chandpaul Ghaut by the Brigeetullow, through Bowanepore and Russapugly, crossing Tolly's Nullah at Coodghutta Ghaut, giving the following results, which I combine with observations on the rises of the Tide at both places ; those in the Hoogly are on the authority of a Register kept by Mr. Kyd, and those in the Puttoory by myself :—

	<i>Ft. Inc. 10th</i>		
Kamapookrea, (the Temple,) is lower than the line marked on the Stone at			
Chandpaul Ghaut,	7	4	9
The point of section C. D. (Map of the Puttoory,) is lower than the Temple,	2	2	6
<hr/>			
The point of section is therefore lower than Chandpaul Ghaut,	9	7	5
High Water Spring Tide in January is below this point,	0	5	2
<hr/>			
Ditto ditto, lower than Chandpaul Ghaut,	10	0	7
<hr/>			
Ditto ditto, in April, lower than the point of Section,	2	1	2
<hr/>			
Ditto ditto, lower than Chandpaul Ghaut,	11	8	7
<hr/>			
Low Water Spring Tides in April, lower than C. D... .. .	6	9	1
<hr/>			
Ditto ditto, lower than Chandpaul Ghaut,	16	4	6
<hr/>			
Rise of the Spring Tide in April, at C. D.	4	7	9
<hr/>			
The highest known rise of the Tide in the Hoogly, was below the line on the			
Stone at Chandpaul Ghaut,	2	6	0
<hr/>			
The mean rise of the Tide in the Hoogly, from November until June, is below			
the Stone,	8	5	3
<hr/>			
The mean of the least rise from November until June is,	14	9	7
<hr/>			
The mean of the least rise from June until November,	11	7	6
The mean of the Ebbs is below the Stone,	15	0	0
<hr/>			

This abstract will appear more clearly, by reference to the Levelling Section Plan, where they are laid down, and the comparative states of the Tides will be comprehended at one view. The Tides at Kamapookrea are about one hour later than at Calcutta.

The General Map will shew the country through which the whole line of the Canal is to run, and how far its Excavation is likely to interfere with villages. In a Cut of such an extent, it cannot be expected that a line could be marked out which would run clear of every Village and preserve its direction. In a country so thickly populated, as that through which this Canal is to be cut, it is impossible. By reference to the Map it will appear, that if the Cut is made perfectly straight, it must go through many villages, but by a slight deviation some of them may be avoided, and where this cannot be effected without such a considerable sweep as would materially increase the distance and expence of cutting, it will not, comparatively speaking, be of much consequence to carry it through a village. The value of village ground was generally stated to be four times greater than the open cultivated land, and no unwillingness was manifested by the inhabitants to part with it, provided other places were assigned for their habitations. In the low grounds, particularly the Fresh Lake, the villages are compact, and may be avoided by a slight curvature in the direction of the Canal, but in the higher grounds the huts are scattered at such intervals, that the Canal might be carried through the centre of a village, without the necessity of removing more than fifteen or twenty houses perhaps. The greatest difficulty on this account may be anticipated at Gowriepoor, Meerpoor, and Kiristallah; at these places the huts are extensively scattered, and the villages so close, that any attempt to avoid one would lead direct to another, and one preponderating consideration against frequent deviation from a right line, is the increased action every curvature would inevitably give to the current on the sides of the Canal.

The point from whence I would propose the cutting to commence, marked A in the Levelling Section, and C H in the Map of Tolly's Nullah, is about 4000 feet South of Kamapookrea, where the section of the Puttoory gives a breadth of $34\frac{1}{2}$ feet, and a depth of 6. My reasons for fixing on this point are briefly, that from thence an uninterrupted plain extends for two miles South to Kurreempoor, and that going higher up the Puttoory, would carry the Canal too far East, for which there is no inducement in the Nullah itself, as it immediately contracts to a breadth of 25 feet, and becomes very shallow, the Tides flowing no higher than Bagesie. To satisfy the Committee, should any question arise on the subject, the survey of this Nullah was carried as far South as Jhinkee. From Bagesie for two miles, it is traced by a succession of stagnant pools of Water, and afterwards it can only be distinguished from the adjacent country by the marks remaining in it of the canoes which navigate it in the rains.

From the point above mentioned, as being eligible for the commencement of the Canal, the country is nearly on the same level for four miles; viz. about $4\frac{1}{2}$ feet above the level of the Low Water Spring Tides, which I have assumed as my base line of Levels, in the Levelling Section, (and to which, in speaking of the levels I shall always refer,) and is that Morass usually called the Fresh Lake; it there gradually rises until it attains its greatest height, which is $7\frac{1}{2}$ feet near Gowrypoor, when it again falls rather below the former Level to Oostee, giving a mean of 5.2 feet above the base line of Levels for the whole distance.

The Fresh Lake is inundated from the commencement of the rains until the middle of March. In January last, there was four feet water on it near Gopaulnugger, and communication between the villages was maintained by Canoes. These villages are raised but little above the Level of the Inundation, and the general mode of forming them appears to be, by excavating a number of small Tanks, and forming mounds with the earth so obtained on which the huts are erected.

The whole country between Kamapookrea and Oostee, appears by the soil and the weeds growing upon it, to be subject to protracted Inundation, and the inhabitants invariably stated it to be so, to the depth of three and four feet from the beginning of the rains, and draining off in February. From this general remark, must be excepted the higher ground alluded to above, which is a ridge that will cross the course of the Canal at Gowrypoor. It has no appearance whatever of being subject to Inundation, certainly not for any considerable time, though the inhabitants assert that it is. The soil instead of being the black heavy mould of the lower ground, is light and sandy, and cultivated for various productions different, from those of the other soil. It is enclosed, planted, and almost covered with huts and villages. This ridge can no way be avoided, except by a sweep of four miles to the eastward, for it extends from Jhinkee to the Diamond Harbour Road, and I believe on to the River Hoogly, fortunately it is not more than 4000 feet across from Meerpoor to the Southern extremity of Gowrypoor.

From Gowrypoor to Oostee, the soil is similar to that of the bed of the Fresh Lake, and apparently subject in the same manner to Inundation. The plain to the North of Oostee had three feet of water on it on the 1st of March last, but this was occasioned by the extraordinary high Spring Tides of the preceding month, and a heavy fall of rain. In the latter end of January, it was nearly dry.

At Oostee, the Creek from Diamond Harbour crosses the Old Road leading to Koolpee. I shall reserve the few remarks I have to make on this Creek, and state what further I have to say on the remaining part of the course of the Canal.

From Oostee to Hotogunge, the Ditch on the side of the Old Road may easily be made navigable, as will appear on reference to the Sections given with the Survey, and which were taken for every variation of breadth and depth. This Ditch is crossed in several places by small but deep Khals running from a Morass west of the Road, and communicating with the Sunderbuns. It finally joins the old Chingry Creek at Sawindah, which is shut up by a bund at Hotogunge, the great breadth and depth of this Creek above the bund, while scarcely a trace of it remains below it, shews, that if the Tide should be again allowed to act, and have access to the Ditch in the same manner it had to the Nullah or Creek, it would soon acquire sufficient breadth and depth, without any expence or trouble more than straightening its course when it crosses from one side of the road to the other; in other respects it is direct the whole way. The surface of the water at the bund at Hotogunge was $7\frac{1}{2}$ inches lower than that in the Ditch at Oostee, from which I conclude the fall of the country must be nearly the same.

NOTE.—There was a bund across the ditch near Soorachee.

At Hotogunge, the Spring Tide rises in the Chingree Creek below the bund about $1\frac{1}{2}$ feet, it is confined to a certain space by bunds, within which a considerable quantity of salt is manufactured; but owing to the Tide being debarred from a higher access by these bunds, the Creek is rapidly filling, and the people were engaged in deepening its bed, I presume, for the purpose of securing a continued flow of the Tide for the benefit of the salt works.

From the immediate neighbourhood of Hotogunge, the Old Road continues to Gopalnuggur, within two miles of Koolpee, where it is lost in the rice grounds, or beyond which it very possibly never was carried. The line of this road seems most eligible for the Canal, not only from its running exactly in the proper direction, but as being nearly free from any interruption from villages. No remains of any Ditch or Excavation that can be at all available for the Canal exists, except the very trifling one from Hotogunge to Chundeeipoor.

The road is said to be the property of the descendants of Rajah Nobkissun, who constructed it; as a road it is quite useless, but it may be of some value to the proprietors, on account of the Babool Trees which grow abundantly on it.

From Gopauluggur to the head of the Bhortullah Khal, which communicates with Channel Creek, the country is perfectly flat, a heavy black soil, apparently not very productive or much cultivated. No obstruction of any kind occurs except the villages, which are numerous and close, the line for the Canal will therefore be regulated with reference to the proximity of the River Hoogly, and the chance of its encroaching so as to join the Canal; of this there does not at present appear to be any probability. I surveyed and accurately examined the whole of the bank of the River from Diamond Harbour to the mouth of the Tengra Beechee Khal. From Diamond Harbour to Koolpee has nothing to do with the present consideration, further than it may be remarked, that the Kantaburya Point is calculated to direct the force of the Stream to the opposite side of the River, where Mr. Chalke, the Harbour Master at Diamond Harbour informed me, the bank was cutting away very fast; but even including this, there is no appearance of progressive cutting any where of the bank; on the contrary, at Low Water, there is from 400 to 1200 feet to the High Water Mark, and this more particularly from Koolpee to Rangafullah, as will be seen by reference to the Survey, which was made expressly to illustrate this subject.

Throughout the whole extent of the line of the Canal, the country is sufficiently populous to afford any number of hands required for excavating it. Should people from a distance be employed, a difficulty on account of fresh water might be apprehended to the South of Koolpee, where there is scarcely sufficient to supply the wants of the Inhabitants. Two or even three villages frequently depend on one Tank for Water; this does not occur from a paucity in the number of Tanks, they are numerous, but so ill secured against the Tides, that the water is generally spoiled.

Some part of the Canal will run through ground which is never cultivated, and when through cultivated ground it will generally be of that kind, which yields but one crop in the year of from four to six maunds of rice per Biggah. The value of the former ground is perhaps six Rupees per Biggah, and the latter was stated to be from 20 to 40 Rupees.

It now only remains for me to make a few observations on the state of the Diamond Harbour, Chingree, and Koolpee Creeks. The two latter are of little importance, they are both dry at low water, and can only be made available to supply the Canal with water, should it be necessary.

The Diamond Harbour Creek is navigable for large boats in all states of the Tide as far as Bagesie, (vide Map,) at which place there is water sufficient to float a 14-oared Pinnace at low water; above this however the Creek takes an abrupt turn, at a point where a large Khal, now closed, formerly joined it, the banks become steep and broken, and the bottom is choked with roots and stumps of trees; the breath from this gradually diminishes to 25 or 30 feet, with a depth of six feet, and at Dyarack, where the Creek is bunded across, it is dry at Low Water below the bund. The course of this Creek winds very much, but with the exception of one or two places near Budertollah, the banks do not appear to suffer considerably from the action of the current. Many inferior Creeks communicate with it on both sides, but they are almost all closed by bunds. The Spring Tides rise above the banks the whole way, and are prevented, though not effectually, from inundating the country by bunds on each side, within the bunds of which a great quantity of salt is made.

The first principal turn of the Creek near the Bazar of Diamond Harbour, was partly cut across by order of Mr. Elliot, but as the Cut was never opened, it now serves as a Tank of fresh water, from which the Ships lying at Diamond Harbour are supplied.

From a Sluice near the Harbour Master's house, which was selected as a permanent station, a series of Levels, very carefully taken and proved by levelling back, were carried on to Oostee and terminated at a stake four feet long, driven into the ground at the point

where the Canal will probably join the Old Road, the result of these Levels, and my observations of the rise and fall of the Tide at Diamond Harbour, are as follows:—

	<i>Ft. In. 10ths.</i>		
The Head of the Stake at Oostee is lower than the Ledge of the Sluice at			
Diamond Harbour,	4	9	8
The Head of the Stake is above the base line of Levels,	6	2	2
<hr/>			
The Ledge therefore is above the line of Levels,	11	0	0
<hr/>			
Ditto above the low water Spring Tide Mark in February,	20	8	7
<hr/>			
The greatest known rise of the Spring Tides, was above the Ledge,	3	5	3
<hr/>			
The Spring Tide in February, was below the Ledge,	1	6	6
<hr/>			
Mean rise of the Spring Tides, below the Ledge,	3	5	7
<hr/>			
Lowest Ebb of the Neap Tides in May, below the Ledge,	17	4	7
<hr/>			
Least rise of the Neap Tides in May, ditto,	7	7	4
<hr/>			
Rise of Neap Tide in March, according to Mr. Chalk,	13	10	3
The actual rise of the same Tide was,	5	0	0
<hr/>			
The Ebb therefore must have been, below the Ledge,	18	10	3
<hr/>			

As the Ebbs correspond with the Flows of the Tide, that is, the higher a Tide rises the lower the Ebb falls, and the contrary; it would appear, on comparing this result with those above detailed, that the observation was inaccurate. Mr. Chalk was certain as to the actual rise of the Tide being five feet, but as he could not point out exactly any spot to which it rose, but only generally in the bed of the inlet near the Jetty, which was choked with soft mud, it is probable an error occurred in obtaining the difference of Level between it and the Sluice Ledge, and it is probable it rose to within ten or eleven feet of the Ledge.

On comparison of the rises of Tide at Diamond Harbour, with the Surface Level of the Canal at Oostee; viz. six feet above the base line of Levels, it is observable that in cases of extraordinary low Neap Tides, they will not rise to the Level of the Canal, and that frequently in high Spring Tides they will rise above it, but none of these rises are applicable at Oostee. For the Tide flowing in a confined Channel, a distance of nine or ten miles will be considerably retarded by friction against the sides and bottom of the Channel, so that the actual rise at Oostee will never correspond with the actual rise at Diamond Harbour. The very high Spring Tide in February last, rose about a foot on the plane North of Oostee; viz. about $5\frac{1}{2}$ feet above the base line of Levels, while it rose at Diamond Harbour 9 feet and 5 inches above the same line, giving a difference of 3 feet 11 inches as the loss of rise. If this result were applicable to all rises of the Tide, it is obvious that the generality of the Neap Tides would barely rise to the Level of the Canal, and some scarcely so high, without any allowance for the rise of the Tide in the Canal itself, which is likely to be contemporaneous; but it is not probable that the decrease of the rise in Spring and Neap Tides will be equal, on account of the diminished velocity with which a smaller body of water flows in the same Channel. It will therefore be for consideration, if a Sluice at Oostee is adapted to keep the

communication open? If Locks must not be substituted? Or if some point between Oostee and Diamond Harbour might not be selected, where a more equable rise of the Tide would render Sluices available.

With reference to the construction of Sluices or Locks at Oostee, a well was sunk there to the depth of 25 feet, to ascertain the nature of the soil for a foundation at that depth; the workmen came to sand, and the water gained so fast on them, that the well could not be kept clear; further prosecution of it was therefore necessarily abandoned, and the water immediately rose 15 feet. The whole of the neighbouring country being inundated, and the Ditch on the road side full, may partly account for this occurrence. The following is a Table of the strata :—

1st. Light brown Clay, mixed with vegetable matter,	..	..	..	4 Feet.*
2nd. Brown Clay, mixed with some sand,	..	..	..	2 „
3rd. The same, darker and veined with ochre,	..	..	..	2 „
4th. Dark blue terraceous Clay,	..	..	..	6 „
5th. Light blue Earth and Sand,	..	..	..	5 „
6th. The same, but more sandy,	..	..	..	6 „
				25 „

Specimens of these different strata were brought to Calcutta, when the brickmakers declared the two last to be of an excellent quality for making bricks, with the addition of a little more sand.

I trust, I have not omitted any thing of consequence in the above communication; but if I have, I shall be happy to supply the defect as far as may be in my power, if you will inform me of it.

I am,

Sir,

Your most obedient servant,

(Signed) *J. W. TAYLOR,
Assistant Superintendent of Canals.

(A true Copy,)

CHAS. PATON,

Officiating Secretary, Canal Committee.

Qy. T. M. Taylor.
J. M.

CALCUTTA,
August 28, 1824.

No 29.

To HOLT MACKENZIE, ESQ

Secretary to Government in the Territorial Department.

No. 99.

SIR,

I am directed by the Canal Committee to acknowledge the receipt of a Letter from you, under date 30th of July last, informing the Committee, that Government had determined to postpone the prosecution of the Channel Creek and Diamond Harbour Canals, and requiring them to submit a succinct account of the progress of the Eastern Canal, together with their opinion on what reduction of Establishment can be made in that or the Iron Bridge Department, with reference to the entire or partial Suspension of the Works now going on.

2. Having called on Captain Schalch for his sentiments, with regard to the proposed reductions, the Committee have received from him a Report, dated the 19th ultimo, of which a copy is herewith transmitted. Captain Schalch has divided the subject of his Letter into two parts, and the Committee propose in the first instance to follow his example in offering such remarks as have occurred to them on a consideration of it, reserving for the conclusion of this letter any observations of a general nature, which the conduct of the duties confided to them may suggest.

3. First, on the subject of Iron Bridges since the receipt of Captain Schalch's Letter, the Committee have received the orders of Government, (dated the 15th ultimo,) on the subject of the Bridges on the Cuttack Road, adverted to in the 2nd and 3rd Paragraphs, and no time will be lost in having them forwarded to Balasore. The Committee beg to suggest, that the Military Board may be requested to obtain from the Barrack-master at Benares, his opinion and estimate on the Bridge proposed to be built over the Soombah Nullah.

4. The Committee cannot but regret that the expense actually incurred in the construction of the Rivetment Walls for the New Bridge at Kidderpore,* has so far exceeded the sum originally contemplated, at the same time they deem it an act of justice to Captain Schalch, to bear testimony to the difficulties which he had to contend with in sinking the foundations of the Masonry, and to his indefatigable exertions in overcoming them. The Committee think it desirable, that Captain Schalch in submitting any future Estimate for the erection of Suspension Bridges, should make a liberal provision for contingencies of this nature, which are always liable to occur, and cannot be guarded against, in order that the Government may be better able to determine on the expediency of any work proposed with reference to the expenditure likely to be incurred in its execution.

* Vide Para. 7, 8, 9, 10, 11, 12, of Captain Schalch's Report.

	Rs.
Actual Expense of Walls	9,187
Original Estimate, ..	3,570
	<hr/> 5,617
Additional for Embankments,	6,111
Total ..	11,728 excess.

5. Assured as the Committee are, that the sum in excess of the Original Estimate for the Rivetment Walls at the Kidderpore Bridge has been necessarily incurred, and that the expense has originated in causes beyond Capt. Schalch's control, they beg to recommend that it may be authorized by Government. The improvement noticed in the 12th Paragraph having been sanctioned by the orders contained in your letter of the 8th ultimo, the construction of the Piers will be immediately proceeded upon, under the Superintendence of Captain Baker, who has been instructed to take charge of the Iron Bridge Department, and to submit his Accounts in the prescribed form, during the time we are deprived of Captain Schalch's services.

6. Adverting to the remarks contained in the 14th and following Paragraphs of Captain Schalch's Report, on the subject of Iron Bridges, to the important benefits which will accrue to the Public from their more general introduction, and to the facts, that if a moderate Toll be levied on the Bridges wherever constructed, the Government need not ultimately be put to any expense on account of them; the Committee are induced strongly to recommend that the Establishment now kept up for carrying on the business of preparing them may not be reduced, and that the Bridges over the Coramnassa River and Soombah Nullah, which have been long in contemplation, should be proceeded upon.

7. Wherever they may be erected, the Committee are of opinion, that the Report suggested in the 22nd Paragraph of Captain Schalch's Letter, should be made to him annually, by the Magistrate of the District, or the Barrack-master of the Division in which the Bridge may be situated, informing him of the state of the Bridge, and of any repairs that it may require.

8. It will appear from the annexed abstract Statement* of expenditure incurred from the appointment of the Committee in March 1823, up to the 31st of July 1824, that Captain Schalch has drawn the sum of

	Rs.
On account of Bridges,	83,857
Ditto of the Yard,	16,066
	<hr/> Rs. 1,04,923

1,04,923 Rs. on the Suspension Bridge and Yard Account, to

* Appendix B.

which is also chargeable the salary of his Assistant, Captain Baker, amounting to Sa. Rs. 2,633.

9. During the above-mentioned period, the following expenses having been actually incurred on account of the Bridge Department and Work Yard, leaving a Balance in his hand, Sicca Rupees 4,313 : 15 : 1½ to be hereafter accounted for.

The Bridge of Kally Ghaut,	Sa. Rs. 13,922 4 3½
„ Roadway to the Kally Ghaut Bridge,	2,882 0 5
„ Two Bridges for the Cuttack Road,	20,108 2 10
„ Establishment,	3,417 2 6
*Purchase and manufacture of Tools,	5,538 9 10
*Materials, (wholesale purchase of Iron,)	15,998 9 7
Contingent charges of the Yard,	7,630 1 10
*Railing off the Iron Bridge Yard,	2,471 10 5
Kidderpore Bridge,	28,640 7 2
	<hr/>
	Sa Rs. 1,00,609 0 10½

The three items marked [thus*] may be considered as so much stock in hand.

10. The Committee proceed next to advert to Captain Schalch's Report on the Canal operations.

The Chooramonee Canal being under the immediate control of the Commissioner of Cuttack, the Committee do not feel themselves called upon to offer any observations on the progress of that work.

11. In that to Diamond Harbour, which forms the subject of the 29th and 30th Paragraphs of Captain Schalch's Report, the Committee are naturally induced to take a more lively interest, and they cannot refrain from expressing their extreme regret, that after all the trouble and expense that has been incurred, Government should have come to the determination of postponing the prosecution of this important work, in which the Mercantile interests of the country, and the prosperity of the Metropolis are so deeply engaged.

12. The Committee, however, are not without hope, that when the beautifully executed and minute Surveys made by Captain Taylor, with the Memoir which accompanies them, shall be laid before Government, the continuation of this Canal will not be suspended.

13. At all events the Committee venture to suggest, that an opportunity may be afforded to the Mercantile body of the City, who are most interested in the measure, or to other Individuals, to carry the Work into execution by means of private subscriptions, in the way that works of a similar nature are carried into effect in England.

14. The Committee are induced to offer this suggestion under the apprehension, that if once the prosecution of the Canal is suspended, a considerable period may intervene, during which many alterations may take place to affect the data on which the practicability of the work has now been ascertained; the services of the officers who have been engaged in the preliminary enquiries may not be available, and consequently a double expense will be incurred in obtaining the information which has been acquired by Captain Taylor's Surveys.

15. Should this proposal meet the approbation of Government, the Committee are of opinion, that it will be of essential importance to the success of the undertaking, that the Canal Society should be allowed the benefit of Captain Schalch's and Captain Taylor's services in the execution of it, and that a certain number of shares should be taken by the Government as an encouragement to the Work.

16. The expense incurred in Captain Taylor's Survey up to the 31st of July 1824, amounts to Sa. Rs. *10,592 : 10.

Salary,*	Sa. Rs.	6,800	0
Allowances,		3,258	0
Contingencies, ..		534	10

10,592 10

In Excavating†			
the Canal,		982	12 0
In the Bridge, ..		530	1 8

Sa. Rs. 1,512 13 8

17. In the Excavation of part of the Balliaghaut Canal, and the erection of a new Bridge at Kooleea, some additional expense beyond the original Estimate has taken place, but the explanation afforded in the 31st and 32nd Paragraph of Captain Schalch's Report appear to the Committee satisfactory, and they beg to recommend that those sums may be sanctioned.

18. The experiment made of carrying the Canal through the Salt Lake, (Paragraph 23rd and 24th,) by the formation of Bunds for preserving the Channel, as far as it could be tried without the aid of Dredging Boats, seems to have answered Captain Schalch's expectations. The building of these Boats should be immediately commenced upon, and so soon as they are completed, he will be enabled to proceed in this portion of the Eastern Canal, which promises to be of great Public utility in securing a free communication with the City from the Sunderbunds, whence the supply of wood and fish is chiefly derived, even if circumstances should render it necessary to defer for the present the extension of the line of Canals farther to the Eastward.

19. The expenditure hitherto incurred on account of those Canals, and the impolicy of suspending them altogether, forms the next and subsequent Paragraphs of Capt. Schalch's Report; and from a full consideration of the arguments adduced by that intelligent officer, the Committee are induced to coincide with him in the inexpediency of altogether relinquishing the undertaking, and to recommend that the Plan which he has proposed for the gradual accomplishment of it, may be adopted.

20. The Committee must acknowledge, that the progress of the work hitherto has not equalled the expectations which they had formed, nor has it been commensurate to the expense which has been incurred; at the same time they are of opinion, that the experience acquired in a new and difficult undertaking will not be without its utility, and that the explanations afforded by Capt. Schalch, warrant a reasonable and well grounded hope, that the ultimate expenditure on account of excavating the Canal, will not in any considerable degree exceed what was originally contemplated.

21. From the details entered into by Capt. Schalch, the Committee conceive, that the little progress made in the Canal, and the large expense which has attended it, may be ascribed to the following causes:—

1st. To the difficulty of obtaining a sufficient number of Labourers.

2nd. To the excavation of the Canal having been commenced at the most difficult point of the whole line.

3rd. To the employment of an establishment adequate to the prosecution of operations embracing a considerably more extended line of the Canal, than it was found practicable subsequently to effect.

22. Whilst, however, these several causes may have operated against the progress and economy of the work, it must be recollected, that the knowledge of them has been acquired by experience, and that it would be in the highest degree unjust to Captain Schalch to assume, that he might and ought to have guarded against them.

23. The scene of his operations, and the mode of conducting them, was of course left to that officer, and the reasons he has assigned for beginning them at the most difficult point, carry with them considerable weight. It is easy for the Committee now to observe, that had the Excavations been commenced upon in a more open and accessible part of the line, much greater progress might have been effected at a comparatively smaller expense; that less difficulty would have been experienced in obtaining workmen; that the people employed upon the work would have been kept more easily to it; and that upon the whole,

the prospect of ultimate success in the undertaking would have been apparently far more satisfactory and encouraging.

24. It is, however, no small satisfaction to the Committee, that a considerable portion of the most difficult part of the Canal has been accomplished; and it will be observed by the 42nd Paragraph of the Report, that in the latter stage of the operations, the Excavations were made within the Estimated rate of 10,000 Rs. per mile, and that Captain Schalch entertains no apprehensions of that rate being exceeded in future.

25. It appears, (Paragraph 36,) that nearly three miles of the Canal have been completed up to the 31st of July, Captain Schalch had expended on account of this Canal

Excavating the Canal, Rs. 27,165	1 6½	Rs. 99,324:0:8½,	exclusive of his salary and allowances,
Cutting Jungle,	5,270 7 0		
Making Bund,	373 11 6		amounting to 28,831:10,
Establishment, Overseers &c. 10,495	14 0		and the salary of Lieutenant
Contingencies and Tools, .. 9367	3 5½		Prinsep, amounting to 3,746:0:0,
Dredging Boats,	30,807 11 3		making altogether
Outstanding Balance,	15,844 0 0		the sum of 1,31,895:10:8½,
			chargeable to the Canal
			Department.
	Rs. 99,324 0 8½		

26. From this sum, however, Sa. Rs. 30,807:11:3 is to be deducted on account of the Dredging Boats, which have been transferred to the Military Department, and 15,844 Rs. on account of Outstanding Balances, which remain to be worked off, making the expense actually incurred in excavating the Canal and the Contingencies attending it, Sa. Rs. 85,243:15:2½, or Sa. Rs. 28,414:10:5 per mile, for that part of the work which had been done.

27. With regard to the Plan of future proceedings proposed by Captain Schalch, (Paragraph 50 and 51,) the Committee are disposed to consider it the most judicious that can be suggested. They would not, however, recommend that the whole of the Establishment (with the exception noticed in the 51st Paragraph,) should be discharged. Some few Overseers will, they think, be absolutely necessary to Superintend the Workmen, even on the reduced scale of operations proposed; at the same time they are of opinion, that it is desirable to employ Natives instead of Europeans, who have been found little able to bear the effects of the sun and damp to which the nature of the duty exposes them. By this arrangement, too, a considerable expense will be saved in the Salaries of the Overseers, and it may not be necessary to retain them during the rains, (as has been the case with the Europeans,) when the Excavation of the Canal must necessarily cease.

28. The following is a List of the Establishment as it existed when the greatest quantity of work was going forward, and of the Establishment which will be required on a reduced scale, framed in concert with Captain Schalch:—

ESTABLISHMENT

as it existed when the greatest quantity of work was going forward by Day Labourers, not including the Establishment of the Committee.

8 European Overseers, at 30 Rs. each,	Rs. 240	0	0
1 Ditto,	60	0	0
1 Ditto for Dredging Boats,	60	0	0
1 Ditto,	20	0	0
1 Accountant,	80	0	0
1 Writer,	30	0	0
1 Mofussil Cash-keeper,	40	0	0
1 Bengalee Mohurer,	25	0	0
1 Jemadar,	10	0	0
Carried forward,	Rs. 565	0	0

Brought forward,	...	...	...	...	...	Rs. 565	0	0
59 Burkundazes, at 6 Rs. each,	...	...	...	...	...	354	0	0
1 Native Doctor,	...	...	...	...	...	30	0	0
2 Mofussil Sircars, at 25 Rs. each,	...	...	...	...	...	50	0	0
1 Sircar at Salt Water Lake,	...	...	...	...	...	25	0	0
1 Ditto at Mofussil,	...	...	...	...	...	10	0	0
1 Chowkeedar at Salt Water Lake,	...	...	...	...	...	6	0	0
1 Writer at Mofussil,	...	...	...	...	...	25	0	0
1 Accountant at ditto,	...	...	...	...	...	80	0	0
1 Chowkeedar at Kooleea Bridge,	...	...	...	...	...	5	0	0
3 Calassees at the Dredging Boat,	...	...	...	...	...	15	0	0
1 Head Shikaree,	...	...	...	...	...	8	0	0
10 Shikarees, at 6 Rs. each,	...	...	...	...	...	60	0	0
1 Chowkeedar at Mofussil,	...	...	...	...	...	5	0	0
Per Mensem,						Rs. 1,238	0	0

ESTABLISHMENT

that will be required in the reduced Scale, not including the Establishment of the Committee.

8 Native Overseers, at 16 Rs. each,	...	...	...	...	Rs.	128	0	0
1 Accountant,	...	...	...	...	...	80	0	0
2 Sircars, at 25 each,	...	...	...	...	...	50	0	0
3 Writers, at 20 Rs. each,	...	...	...	...	...	60	0	0
1 Head Shikaree, at 8 Rs.	} in those parts only where there are Jungles,	}	...	...	...	68	0	0
10 Shikarees, at 6 Rs. each,								
2 Chowkeedars, at 6 Rs. each,	...	...	...	...	...	12	0	0
Per Mensem, Rs.						398	0	0

29. A considerable part of the larger Establishment has already been discharged at different times; of the smaller one, Captain Schalch will retain at present only such part as may be required for the immediate duties of this office. The Overseers and Shikarees will not be employed till the working season, when the small Establishment above stated, with from 50 to 100 Labourers, will form the whole expense of the Canal operations, exclusive of the Salaries of Captain Schalch and Lieutenant Prinsep.

30. As far as circumstances may admit, Captain Schalch will of course afford, to those who have received advances an opportunity of working off the Outstanding Balances against them, which, under other circumstances, can only be recovered by legal process.

31. The purchase of land in the vicinity of the Circular Road, for the purpose of connecting the Eastern Canal with the Hoogly River near Chitpore has, as stated in the concluding Paragraph of his Report, been conducted under the immediate Superintendence of the Committee, aided by their Secretary; up to the 31st of July 1824, the sum of 1,08,306 Rs. has been expended on that account, and since that date, further purchases have been made, the whole of which will be found in a statement appended* to this address, shewing that the average rate of the ground hitherto purchased, including Buildings, has fallen considerably short of the sum of 60† Rs. per Cottah, originally contemplated.

* Appendix A.

† 52 Rs. is the average inclusive of Buildings, 40 Rs. exclusive of them.

32. It is not unknown to Government, that the Committee has experienced some difficulty in effecting these purchases, which might, however, have been carried to a greater extent, had not the Committee been anxious to proceed in the first instance without the intervention of Arbitrators under the Provisions of Regulation I. 1824. The progress of improvement in the City always accompanied, as it has been, with an increase in the value of Premises adjoining any Road opened by the Lottery Committee, has rendered the acquisition of ground to an extent necessary to secure the quantity of Land required for the Canals, Roads, and Surplus Ground for resale, a matter of difficulty, and in a very early stage of their proceedings, the Committee discovered that combinations had been entered into to defeat the objects they had in view.

33. In some instances these were overcome, and in others they will be eventually surmounted by calling in the aid of the Regulations above-mentioned, but the consequence has been, that the purchases have been made in detached parcels on the intended line of Canal, and the Committee apprehend, that if this part of their operations is suspended, the difficulty of obtaining hereafter the intermediate spots will be enhanced, and the ultimate expense of purchasing them greatly increased. It may be also urged in favour of going on with these purchases, that the ground may be resold without loss, should the entire abandonment of the Eastern Canals, (which the Committee do not contemplate,) be at any time determined upon. Indeed, the Committee are of opinion, that the opening of a communication between the River North of the Town, and the Salt Lake and Sunderbund Rivers, would be attended with important advantages to the Internal Commerce of the Country, even if circumstances should render that measure indispensably necessary. For the foregoing reasons, the Committee do not hesitate to recommend that their proceedings in this branch of their duty may not be interrupted. In the event of this arrangement meeting the sanction of Government, the Committee are desirous of being authorized to retain Mr. Turner in the capacity of Surveyor on his present allowances, for the purpose of completing the Surveys and Plans of premises purchased for this part of the Canal, as he would otherwise be discharged on the reduction of the Establishment. It will also be necessary to entertain on the Secretary's Establishment, an additional Native Ameen at 20 Rs. per mensem, to attend Mr. Turner, and point out to him the situation and boundaries of the parcels of Ground, to be inserted in his Survey.

34. Having thus far delivered their sentiments on the several points noticed in Capt. Schalh's Letter, the Committee feel it incumbent upon them to offer, in conclusion, a few general remarks on the various and extensive duties which have devolved upon them since their first appointment, and on the prospect they entertain of bringing them to a successful termination.

35. In March 1823, the Committee was appointed for the express purpose of Superintending the construction of a line of Canals, with a view to facilitate access to the City from the Eastern Districts of the Lower Provinces, by which the important object of a safe and permanent communication with the Ganges at all seasons of the year was also contemplated. Captain Schalh was placed under their control as Agent for the preparation of Iron Suspension Bridges, to be erected in different parts of the Country, and shortly after this, the scheme of opening a Canal to Channel Creek was brought forward, the conduct of which was also committed to their Superintendence.

36. The Committee are not led to these observations by any wish to shrink from the duties which have been thus assigned to them, but for the purpose of adverting to the magnitude of the responsibility which they involve, and soliciting the consideration of Government to the expediency of their having the means of conducting them with efficiency and regularity.

37. The Committee allude more particularly to the changes which have already

taken place in the several Officers placed under their instructions; within the short period of its appointment, the Secretaryship of the Committee has been in three different hands. Captain Schalch has been once deputed on special duty to Chittagong, and the Committee are now informed that Captain Taylor and himself [Capt. Schalch] have been placed at the disposal of the Commander-in-chief, by which the Committee are likely to be deprived of their valuable services for a length of time.

38. As the Projector of Canals and Suspension Bridges, the Committee have relied with implicit confidence on the best exertions of Captain Schalch towards their successful completion; and without detracting from the merit of those to whom the prosecution of these works may be consigned, it may be fairly doubted, whether those persons will take the same intense interest in their success that Captain Schalch must naturally feel; the Committee therefore venture to express a hope, that whenever circumstances will admit of it, Captain Schalch may be immediately directed to resume charge of the Superintendence of the above work.

39. The Committee deem it their duty to observe in this place, that the accounts of the works carrying on, have not been always submitted by Captain Schalch with that regularity which is essential to the exercise of an efficient check upon the expenditure. This is in some measure owing to the interruption which has occurred from Captain Schalch's absence on Military duty at Chittagong; but the Committee think it desirable, that strict injunctions should be issued to the Officers acting under them, that the accounts of one month should never be postponed beyond the 15th of the next, and that an abstract account should be regularly furnished at the end of each quarter, of the Receipts and Disbursements of the preceding three months.

40. Without greater attention to this point, it is impossible for the Committee to form a judgment how far the progressive expenditure may bear proportion to the expense originally contemplated, when the several works received the sanction of Government.

41. Under the assurance from Captain Schalch, that the Excavation of the Canal will not in future exceed the rate of 10,000 Rs. per mile, on which his calculations were first made, it is unnecessary that the Committee should again advert to the high rate at which the Excavations have been commenced. But the Committee conceive it incumbent upon them to prepare the Government to expect, that the expense of Superintendence, Establishment, and other Contingencies, are likely to exceed in a very great degree the original estimate.

42. In the 59th Paragraph of the Report of the Special Committee, dated 20th March 1823, the expense on these heads is computed at 1,00,000, or at most 1,25,000 Rupees on account of the Eastern line of Canals, whereas it will be found, if the salaries and allowances of Captain Schalch, Lieutenant Prinsep, and the Secretary to the Committee are taken into the account, and the expense of the inferior Establishments and Contingencies added to it, that the charge on those several heads up to the 31st of July 1824, amounts to the sum of 67,236,7 Sa. Rs.

Captain Schalch's Salary, Sa. Rs.	16,366	10	0
Ditto Allowances,	12,465	0	0
Canal Establishment,	10,495	14	0
Contingencies and Tools,	9,367	3	5
Lieutenant Prinsep's Salary, ..	3,740	0	0
Secretary's Salary,	3,280	0	0
Ditto Allowances,	1,500	0	0
Ditto Office Establishment, ..	6,085	0	0
Ditto Contingencies,	3,936	4	7
<hr/>			
Sa. Rs.	67,236	7	0

43. If this is taken as the expenditure of 16 months, the average per mensem will be Rs. 4,202:4 and allowing five years for the probable period of completing the Canals, the expense of Superintendence, &c. will be 2,52,135, instead of 1,25,000 Rs. as originally provided for. It certainly might be urged, that the inferior Establishments, under the new plan of operations, will be less expensive, and the contingencies smaller, but then it must be recollected, that the work will be far less expeditiously carried on, its probable termination extended to a more distant period, and consequently the ultimate expenditure on those accounts much larger.

44. It is not clear, however, from the report of the Special Committee, that they reckoned on the Salaries and Allowances of the Officers abovementioned being included in the expense of Superintendence, the only Establishment specifically provided for in the report (vide Paragraph 73,) are 13 European Overseers, with the same number of Sircars and Boats, and in Paragraph 77, the Committee distinctly anticipate the performance of the duties of the Secretary by the Junior Member of the Controlling Committee.

45. The Committee would not wish it to be understood from the foregoing observations, that they entertain any doubts of the success of Captain Schalch's Plans, or of the important benefits which will in the end accrue to the Country at large from their completion; at the same time they have deemed it their especial duty not to conceal from the Government the results of the experience which has been obtained during the progress of their operations.

46. It is requested that the Plans and Surveys forwarded herewith, may be returned when no longer required.

I have &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
18th November, 1824.

(Signed) CHARLES PATON,
Officiating Secretary, Canal Committee.

CANALS.

BRIDGES.

YARD.

(Signed) C. PATON,
Officiating Secretary, Canal Committee.

2,18,951 0 0
1,91,356 14 5

27,594	1	7	Balance in Capt. Schalch's hands on 31st July, 1824.
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H. SHAKESPEAR,
C. R. BARWELL.

No. 30.

To C. PATON, ESQ.

Officiating Secretary to the Canal Committee.

Revenue, the 24th December 1824.

SIR,

I am directed by the Right Honorable the Governor General in Council to acknowledge the receipt of your Letter, dated the 18th ultimo, together with the Reports and Plans submitted by Major Schalch and Capt. Taylor, and to communicate as follows:—

Suspension
Bridges.

2. Under the circumstances stated in the 6th and following Paragraphs of your Letter, and in the Papers therein referred to, His Lordship in Council concurs with the Committee in thinking it advisable, that the Establishment now kept up for carrying on the business of the Iron Bridge Department should be continued, and that the Bridges proposed to be constructed over the Coramnassa River and the Sombah Nullah should be proceeded upon.

3. His Lordship in Council is not immediately prepared to determine how far the levying of Tolls could be expediently attempted. If any where attempted, the experiment should first be tried in the vicinity of the Presidency, and of Stations where an European Officer resides: and, other things being equal, a preference should be given to places where Police and Custom-house Chowkees are fixed, and where a part of the community at least are already subject to detention. Whatever Tolls are levied must be strictly applied to the repair and construction of Bridges and Roads in the vicinity. And though it is of course a very desirable thing to give to the community the convenience of such public works without the drawback of a Tax, and especially of a Tax so levied, yet as there is little prospect of our being able to assign from the general Revenues of Government, a sum at all approaching the demands of the Country for public works of the kind, the collection of Tolls cannot be disallowed on any such general objection. In each case, the benefit to accrue must be weighed against the probable burthen and annoyance; and as the pecuniary demand must in each individual case be light, so our arrangements should be so framed, as to avoid every occasion of unnecessary vexation.

4. It remains only to state, that His Lordship in Council will be happy to receive from the Committee any specific suggestions, which it may appear to them useful to submit to Government, with a draft of any rules that may be necessary to give effect to them.

5. His Lordship in Council sees no reason to think that Government has been put to any unnecessary expense by Captain Schalch in the construction of the New Bridge at Kidderpore, and the necessity of that work is such, that there could have been no hesitation in undertaking it, even had a larger Disbursement been necessary.

6. The expense incurred will accordingly be sanctioned. But His Lordship in Council cannot refrain from observing, that the causes to which the excess of expense is to be attributed, though beyond control, appear to be such as with reference especially to the attempts adverted to by Captain Schalch, might have been foreseen: and Estimates which admit of such extraordinary differences, are of course worse than useless. His Lordship in Council trusts, however, that with the experience Captain Schalch has now had, no similar errors are hereafter likely to occur: and he relies with confidence on the care of your Committee to check any into which the laudable order of a Projector is always more or less likely to betray him.

7. It appears to be highly expedient, as suggested by the Committee, that wherever Suspension Bridges are erected, the District Barrack-masters should furnish the Superinten-

dent with an Annual Report. The necessary orders for giving effect to this suggestion, will be issued from the Military Department.

8. The Survey of the Proposed Line of the Diamond Harbour Canal appears to have been executed by Captain Taylor, in a very satisfactory manner ; and His Lordship in Council sees no reason to think, that the benefits of that work, or the facilities of executing it, have been overrated. But since at present neither the services of Captain Schalch, nor those of Captain Baker are available for the work, it appears, independently of financial considerations, to be expedient to postpone it.

9. For several reasons, His Lordship in Council prefers keeping the work in the hands of Government, and any Private Society would doubtless labour under much disadvantage if denied the services of Captains Schalch and Baker, which cannot be devoted to the work at the present moment.

10. The expense incurred by Captain Schalch in excavating the Balliaghaut Canal, and the construction of a temporary Bridge at Kooleeah, is sanctioned.

11. The early completion of that part of the Eastern Canal which runs through the Salt Water Lake, appears to be an object of very considerable importance, even though the rest of the work should be suspended. His Lordship in Council concurs, however, with the Committee in thinking it advisable, if practicable, to carry on the General Plan, though on a modified system of operations. But His Lordship in Council regrets, that it is impossible at the present moment to spare the services of Lieutenant Prinsep, for the purpose, and Captain Schalch's attention must, it is apprehended, be for a time at least exclusively directed to the duties which he has to discharge under the orders of His Excellency the Commander-in-Chief.

12. Unless, therefore, the Committee shall be able to find a substitute for Lieutenant Prinsep, among persons not in the Service, His Lordship in Council apprehends that the scale of operations in the ensuing year must be restricted within still narrower limits than they contemplate. On this subject, His Lordship in Council is desirous of receiving a further report from the Committee in regard to the course they may consider it best to follow under present circumstances.

13. The purchase of Land in the vicinity of the Circular Road, appears to have been effected on highly advantageous terms ; and Government is greatly indebted to the Committee, for what has been accomplished in this branch of the scheme. It appears to be clearly expedient to go on with the purchases as the Committee propose, and His Lordship in Council authorizes the Committee to retain Mr. Turner, and a Native Ameen, for the purpose of completing the Surveys and Plans of the premises to be purchased.

14. His Lordship in Council unites with the Committee in regretting the circumstances which have rendered necessary so frequent an alteration in the disposal of the Officers employed under them. But the evil is one which it appears to be almost impossible to avoid, so long as the country shall be without any considerable body of men devoted exclusively to the profession of Civil Engineers. While Government has to select from the Army the persons to be employed in the executive Superintendence of Public Works, it must happen, that the occurrence of war will occasion an inconvenient interruption to their progress : and especially, when the war has to be conducted on [in] an entirely new Country, and under circumstances requiring a more than ordinary combination of means.

15. Should the Committee be able to point out any persons not belonging to the Service competent to conduct the works in question, according to the Plans of Captain Schalch, and subject to such general instructions as that officer may be able to give, His Lordship in Council will be fully prepared to consider any arrangements they may suggest, with a view to the uninterrupted prosecution of them. The Committee justly attach much weight to the regular and early preparation of Accounts. The adjustment of Accounts is

always troublesome in proportion to the delay which occurs in the settlement of them, and it appears therefore to be very desirable, that all Officers acting under the Committee, should furnish their Accounts monthly.

16. The Committee have very properly brought to notice the probable excess in the charge to be incurred on account of fixed Establishments, beyond the sum originally estimated. The difference, however, is not such as to lead His Lordship in Council to doubt the expediency of the undertaking, though in discussing the point, Captain Schalch appears to have assumed much too broadly, that experience has proved the impossibility of keeping open the direct communications between the Hoogly and the Ganges. The experiments made, have been on far too confined a scale to warrant any conclusion either way. But as far as they go, the results appear to favor the expectation, that the great object of keeping open one at least of the Channels in question may yet be attained.

17. The Committee will of course continue to use every practicable means of confining the expense of the Works in question, within the narrowest limits compatible with their efficient execution.

18. The Plans and Surveys are herewith returned, as requested by you.

I am, &c.

(Signed) HOLT MACKENZIE,
Secretary to Government.

No. 33. c.

CHARLES PATON, ESQ.

Officiating Secretary to the Canal Committee.

SIR,

I have to acknowledge the receipt of your letter, No. 34, dated the 25th ultimo, and request you will have the goodness to acquaint the Canal Committee, that in pursuance of their instructions contained therein, I lost not a moment in applying to Messrs. Clarke and Anley, Executors of the Will of the late Major J. A. Schalch, for all Papers, Documents, Maps, Plans, &c. relating to, or connected with the Canal and Iron Bridge Départments, which might be found amongst his (Major Schalch's) Papers. These gentlemen made no difficulty in complying with my requisition, but some delay necessarily occurred in examining and separating the Canal and Bridge Documents from a mass of Papers, not coming within the specification of your letter.

2. I have now the honour to forward, in compliance with the directions of the Canal Committee, two Lists (marked No. 1 and 2,) one of the Maps, Plans, &c., and the other of the Papers and Documents received by me from Mr. W. Anley, one of the Executors of Major Schalch's Will.

3. Besides the Maps detailed in the first List, the Plans, &c. stated in the margin,* were found among Major Schalch's Papers, but as they were marked "Private" in his own hand-writing, and did not appear to be directly connected with the works under the Superintendence of the Committee, I refrained from asserting any claim on public grounds, but consider them of sufficient value and importance to Report their existence for the information of the Committee, particularly the Plan for the proposed Harbour, which it might be desirable to possess in the event of future discussion on that subject.

* Plan illustrative of the Proposed Harbour for Shipping at the Port of Calcutta.
Plan of a Machine for Cutting Piles under Water.
Plan of a Machine for Driving Piles.

4. Many of the Maps and Plans are Duplicates or Office Copies of those already before the Committee. Some are rough Protractions of Surveys, and apparently of little value, I have not therefore arranged or classed them very minutely, and wait the further instructions of the Committee regarding them.

5. Of the Papers and Documents contained in the second List, many are the rough drafts of letters, which have probably been copied into a letter book; many consist of drafts and copies of Memoirs and Reports of little importance; but what I would draw the attention of the Committee more particularly to, is the correspondence, in the form of familiar private notes and letters, relating it is true to the Canal and Bridge Works, but certainly never intended by the writers to be retained as Records in a Public Office.

6. I also forward a List marked No. 3, of one bound, and seven stitched books, which are the Private Journals of Major Schalch, and of course not claimable as public property; but Mr. Anley entrusted them to me for examination, in order to ascertain, if they afforded any information likely to be useful to Government. I have not had time to read them with the attention they demand, but as far as I can form an opinion, from a cursory perusal of them, I think them valuable. They relate almost entirely to the works in contemplation at the time they were kept, and appear to contain, not only Major Schalch's first conceptions of the Plans he subsequently matured, but of many others, some of which may possibly be adopted hereafter, together with much local information on various subjects relating to the Eastern Canal. They serve to develop the ideas of that able Engineer on the works he was entrusted with the construction of, and would enable his successor more effectually to follow up and execute his Plans now, or lately in operation.

I am, &c.

(Signed) * J. W. TAYLOR,
Assistant Superintendent of Canals.

* Query T. M.
Taylor—J. M.

CALCUTTA,
11th April, 1825.

No. 33. c.⁽¹⁾

No. 1.

List of Maps, Plans or Sketches, relating to, or connected with the Canal and Iron Bridge Department, received by Captain TAYLOR, Assistant Superintendent of Canals, in pursuance of instructions from the Canal Committee, from W. ANLEY, ESQ. one of the Executors of the Will of the late Major J. A. SCHALCH, Superintendent of Canals, Calcutta, April 6th, 1825.

Survey of Tolly's Nullah, &c. from its mouth to Kamapookereah.

Section for Floating Gates and a Dock, by Mr. Holcroft, from a Plan by Rennie.

Map with Sections, explanatory of a Plan for improving the Navigation between the Lower parts of the River Hoogly and Calcutta.

Original copy of Captain Taylor's Map of the country between Calcutta and Channel Creek, and one unfinished copy of the same.

Sketch of the Diamond Harbour Creek, by Mr. Chalk.

Map of the communication between Diamond Harbour and Calcutta.

A Survey of Tolly's Nullah, in two parts.

Captain Taylor's Survey of the mouth of Tolly's Nullah, and a copy of it.

Diamond Harbour
Canal.

Diamond Harbour
Canal.

Line of the Road to Diamond Harbour, (a penciled Sketch,) and the country between it and Kamapookereah.

Section, shewing the rise of the Tides in the Hoogly.

A Reduced Map, explanatory of a Plan for improving the Navigation between the Lower parts of the River Hoogly and Calcutta.

Protraction in Pencil of the Road from Rajahaut to Culpee.

Diamond Harbour Canal, with a Plan for a Lock Gate.

Unfinished Map, explanatory of a Plan for improving the Navigation between the Lower parts of the River Hoogly and Calcutta.

A ditto ditto, finished.

Levelling Section and Route between the Diamond Harbour Road and Kamapookereah.

Levels at Diamond Harbour, and the Plan of a Lock Gate.

A Survey of Tolly's Nullah.

Map of a communication between Diamond Harbour and Calcutta.

A Reduced Map, shewing the Line of the proposed Canals of communication between the Hoogly and Calcutta, and a Levelling Section between the Diamond Harbour Road and Calcutta.

Eastern Canal.

A Map of the proposed New Navigation from Koolna to Calcutta, the Plan of the Canals, and the present passage through the Sunderbuns, four engraved Maps.

Rough Protraction of the *Pupae* River, in pencil.

Three Sketches of parts of the Sunderbuns.

Rough Protraction of the Cobulmunee Nullah, in pencil.

Two Sketches of the Road to Diamond Harbour, and one shewing the difference of Level between the Parade there, and the Surface of the Salt Lake.

Rough Protraction of the Banginkhal, in pencil.

Section shewing the difference of Level of the Salt Lake, and four unfinished Sketches relating to the Eastern Canal.

Map of the Eastern Canal.

A Map of the City of Calcutta, with part of the Suburbs and adjacent Country lying to the Eastward, shewing the direction of the proposed Canal of communication with the Hoogly River and the New Passage as far as Tardah.

Four unfinished Sketches of the Sunderbuns.

Map of the New Canal through the Sunderbuns.

Section, shewing the difference of Level in the Dry and Wet Seasons of the Salt Lake.

A Map of such parts of the Rivers Gurray, Komae, Burassee and Moodoomuttee, as form the Navigation between the Ganges and the Sunderbun Passage, together with the Utaree Banka and Mowdew Nullahs.

Four Sketches of the Levels of the Salt Water Lake and the Calcutta Road.

Five rough Sketches relating to the Eastern Canal.

Rough Map of the Eastern Canal.

A Map of the Suburbs and Country S. E. of Calcutta, shewing the direction of the proposed Canal communicating with the Hoogly and Ganges.

The Delta of the Ganges and course of the Eastern Canal, on one sheet.

Morrison's Survey and Line of the Canals through the Sunderbuns.

Rough Protractions and Plans of the Ganges between Koolna and Rajemahl.

Map of the Country between Coolna and Calcutta.

Levelling Section between Dum-Dum and the Salt Lake.

Cuttack Canals.

Two Sketches of the country between the Gummy and Montay Nullahs, shewing the direction of a Canal to join these streams.

Rough Map of the Chooramoonee Canal.

Sections of the Goreekhal and Kuddumkundee Bridges.

Ground Plan of Kallyghaut Bridge.

An unfinished Sketch of a Bridge.

Bridges.

Elevation of an experimental Iron Bridge, erected over Tolly's Nullah at Kallyghaut.

Unfinished Elevation of an Iron Suspension Bridge, believed to be one of those made for Cuttack.

Plan and Elevation of the Kooleah Bridge.

Section of the Julka and Goreekhals, by Captain Stephen.

Elevation of an Iron Suspension Bridge, proposed to replace the present decayed Bridge at Kidderpore.

Unfinished ditto ditto ditto.

Five Plans and Sketches, relating to the New Kidderpore Bridge.

Rough Plan of a Bridge for the Cuttack Road.

Rough Plan of a Pier for the Kidderpore Bridge.

Survey of the Route from Calcutta to Juggurnauth.

A Plan of the Kidderpore Bridge.

Elevation of the entrance to the Kallyghaut Bridge.

Plan and Section of the Kanae Nullah, near Sehora.

Various rough Plans and Sketches for Dredging Boat Machinery.

Miscellaneous.

(Signed) T. M. TAYLOR,
Assistant Superintendent of Canals.

No. 33. c.⁽²⁾

No. 2.

List of Documents and Papers, relating to, or connected with the Canal and Iron Bridge Departments, received by Captain TAYLOR, Assistant Superintendent of Canals, in pursuance of instructions from the Canal Committee, from W. ANLEY, Esq. one of the Executors of the Will of the late Major J. A. SCHALCH, Superintendent of Canals, Calcutta, April 6th, 1825.

Rough Estimate of the expense and rate of Digging Canals.

Diamond Har-
bour Canal

Note to Mr. Mackenzie, and his Reply relating to the Salary of an Assistant.

Seven Notes and Letters from Captain Taylor, relating to the Surveys and Levels for the Diamond Harbour Canal.

Note from Mr. Kyd, relating to the rise of the Tides.

Copy of a Letter to H. Shakespear, Esq., on the Proposal and Plan of a Canal to Diamond Harbour.

Original Draft of the Memoir on the Eastern Canal, with various copies and parts of copies of the same, the whole consisting of 55 sheets of foolscap paper, 3½ of letter paper, and a stitched book.

Eastern Canal.

Report of Lieut. Prinsep, on the Salt Kolareis.

Questions put to Lieut. Prinsep, and his Replies.

Rates of Digging per Chowkah, and List of the Hauths near the line of the Canal, (a Memoir.)

- Eastern Canal. Two Notes from Lieutenant Henderson, relating to Tents, and a List of Pergunnahs.
 Native Petition to Mr. Barwell, from the Salt-makers.
 Translation of the above.
 Application of Serjeant Whitehead, urging certain claims on the Government.
 Original Memoir, relating to the opening of the Eastern Canal, and the effects likely to result from a communication between the Hoogly and the Salt Lake.
 A Letter to Mr. Kyd, relating to the Eastern Canal.
 Paper relating to the construction of the Eastern Canal and Establishment necessary for that purpose.
 Two Memorandums on China Paper of Contingent Charges and Outstanding Balances on the Eastern Canal.
 Twenty-one Notes and Letters from Lieutenant Prinsep, Assistant Superintendent of Canals, relating to the works conducting by him; Reports of Progress, &c.
-

Iron Bridge Department.

- Letter from Captain Broughton, relating to the Cuttack Bridges.
 Copy of a Letter to Captain Craigie, Secretary to the Military Board, in Reply to a requisition for Copies of Plans of Bridges, &c.
 A Note relating to the price of Timber.
 Ditto from Captain Garden, relating to the Iron Bridge Accounts.
 Ditto from Mr. Swinton, relating to a Pattern Bridge for the Bombay Presidency.
 Memorandum of the Weight of the Cuttack Bridges.
 Letter from Captain Playfair, on the Caramnassa Bridge.
 Private Note from Mr. A. Colvin, relating to a supply of Stones from Allahabad.
 Memorandum on China Paper of Receipts and Disbursements in the Bridge Department.
 Memorandum three sheets, on the construction of the Kallyghaut Bridge.
 Two Letters addressed to T. Prinsep, Esq. Officiating Secretary to Government, relating to the Kallyghaut Bridge.
 Letter to H. Mackenzie, Esq., on the Cuttack Bridge.
 Copy of Letters from C. Barwell, Esq. to Mr. H. Mackenzie, relating to the employment of Convicts on the Kallyghaut Bridge.
 To H. Lushington, Esq., relating to an Indent for Smith's Tools.
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Cuttack Bridges & Canal—marked "Capt. Stephen's Papers."

- From H. Mackenzie, Esq. to Captain Stephen, enclosing an extract from the Report of a Committee of Survey on the Juggernath Road, &c.
 Letter to Mr. Mackenzie in Reply.
 Ditto from Mr. Mackenzie, relating to the erection of Iron Bridges of Suspension.
 Two Letters to Mr. H. Mackenzie, and his Replies to them.
-

Four Notes, being a Correspondence with Captain Cumberledge of the Ship *Ganges*, relating to an Hydrostatic Proving Machine, and a supply of Iron and Coals.

Steam Engine and Dredging Boat.

- Four Letters to Mr. H. Mackenzie, on the purchase of a Steam Engine, and construction of a Dredging Boat.
 To Mr. Kyd, relating to the building of a Dredging Boat.
 Note to Mr. Mackillop, relating to the purchase of a Steam Engine.
 To J. Barwell, Esq. Tub-treasurer, with bills for the payment of the price of a Steam Engine.

Seven Sheets stitched together, containing Correspondence, Plan, Estimate, and Report on the Proposed Canal at Chooramoonee.
 Letter from Mr. Blunt, to Captain Schalch, relating to the advantages of a Canal at Chooramoonee.

Chooramoonee or
Cuttack Canal.

Letter to Mr. H. Mackenzie, on the state of Tolly's Nullah.

Tolly's Nullah.

Letter to C. Trower, Esq., applying for an advance of Cash to clear Tolly's Nullah.

A file of Papers, English and Native, being Agreements and Securities with certain persons, furnishing Coolies and Workmen.

(Signed) T. M. TAYLOR,
 Assistant Superintendent of Canals.

No. 33. c.⁽³⁾

No. 3.

List of the late Major SCHALCH's Private Journals.

- No. 1. Private Journal of a Voyage through the Sunderbuns, for the purpose of ascertaining a more commodious and direct Navigation between Calcutta and the Great River than that at present made use of, commenced October 30th, 1820.
 - No. 2. Ditto ditto ditto, from the 11th to the 30th of November, 1820.
 - No. 3. Ditto ditto ditto, from the 30th November to 28th January 1821, and a Journal of a Voyage from Calcutta to Rajemahl and Commercolly.
 - No. 4. Ditto ditto ditto, continued, and return to Calcutta through the Sunderbuns.
 - No. 5. Journal of a Voyage with Mr. Gordon, from Calcutta to Rajemahl, and a Journal of a Trip to Diamond Harbour and Channel Creek.
 - No. 6. From Calcutta to Balasore, December 21st, 1822, to examine the Goreekhal and Kuddumkundee Nullahs; and to Chooramoonee, to examine the ground through which a Canal was proposed to be carried by Mr. Schultz.
 - No. 7. From Chooramoonee to Juggernaut and Cuttack, January 3rd, 1822.
- A bound Book, into which a considerable part of the above Journals have been copied.

CALCUTTA,
 11th April, 1825.

(Signed) T. M. TAYLOR,
 Assistant Superintendent of Canals.

No. 33. e.

To CHARLES PATON, ESQ.

Officiating Secretary to the Canal Committee.

SIR,

I have to acknowledge the receipt of your Letter, No. 44, under date the 22nd instant.

2. In reply to that part of it which conveys the directions of the Canal Committee that I should forward "Lists of all the Private Papers and Documents belonging to the Estate of the late Major Schalch, which I conceive likely to prove useful," I conclude, those only are meant which are in some manner immediately or remotely connected with the Canal or Iron Bridge Works, and therefore, beg leave to refer you to the marginal list of the 3rd Par. of my Letter of the 11th instant, and to the List marked No. 3, alluded to in the 6th Par. of the same letter, which comprise the Lists required.

3rd. Of those enumerated in the first, I do not consider any thing of importance, except the Plan for the proposed Harbour for Shipping.

4. With respect to the Letter I now forward, a List more descriptive of the late Major Schalch's Journals than that which accompanied my last letter, and which I trust is sufficiently so to enable the Committee to form a clear idea of the nature of their contents, I do not, however, attach the importance to them which your Letter appears to imply, but I conceive they would prove extremely useful to whoever may be appointed to carry on the works, planned and commenced by the late Major Schalch.

5. I feel considerable reluctance in attempting to estimate what might be considered a fair remuneration to the Estate of the late Major Schalch, for the possession of these Papers, as the habits of intimacy which existed between us, might operate to render me liable to do more than justice to his heirs. The Committee will therefore receive my opinion with advertence to this circumstance, but perhaps concur with me in thinking, that something may be conceded to the Memory of the late Superintendent's services and talents; with this view of the case, perhaps 400 Rupees might not be considered an unreasonable remuneration to the Estate for the Property of these Papers.

6. I request you will acquaint the Committee, that in compliance with their instruction, I have delivered to Captain Baker, all Papers and Documents relating to the Bridge Department, and I have the honour to forward his receipted List of the same.

7. I request you will do me the favour to solicit the attention of the Committee to the 5th Par. of my Letter of the 11th instant, and I trust they will pardon the liberty I take in suggesting to them, the propriety of returning the Private Notes and Letters alluded to therein, to the writers of them.

I am &c.

CALCUTTA,
28th April, 1825.

(Signed) J. M. TAYLOR, Captain,
Assistant Superintendent of Canals.

No. 33. e.⁽¹⁾*List of the Private Journals of the late Major J. A. SCHALCH.*

Nos. 1, 2, and part of 3 contain the Diary of a Voyage through the Sunderbuns, commenced on the 30th of October, and ending the 7th of December 1820. It was made professedly "For the purpose of ascertaining a more commodious and direct Navigation between Calcutta and the Great River than at present made use of," and comprised a careful examination, and partly the Field Book of a Survey of the different Rivers and Creeks between Calcutta and Koolna, with Observations on the rise, fall, and set of the Tides; various Sections of different Creeks; the nature of the country, soil, expense of clearing the Jungle; the present mode of Navigation and its disadvantages; and Examination of the Salt Water Lake.

The remainder of No. 3 and all No. 4, is the Journal of a Voyage up the Hoogly to Rajemahl, and back to Calcutta via Comercolly and the Sunderbuns, commenced 21st of December 1820, and ending the 8th of February 1821. It contains various remarks on the state of the River Hoogly and Ganges, between Rajemahl and Koolna, and the Rivers communicating with them, as the Jellinghy and Mattabangah; a Survey of the Gurroy and other Rivers; and generally, similar Observations and Remarks to those of Nos. 1, 2, and 3, as detailed above.

No. 5 contains, 1st. Journal of a Trip in company with Mr. Gordon, to Rajemahl in November 1821; 2ndly, an Examination and Survey of the Diamond Harbour Road to Rajahaut, and thence to Culpee; 3rdly, an Examination of Tolly's Nullah and the Puttoory Creek; and 4thly, a Trip to Diamond Harbour and Channel Creek, including an Examination of the Creek communicating with the latter and the New Anchorage. These, with the exception to the first, relate directly to the Plan for the proposed Canal, communicating with Diamond Harbour and Channel Creek.

Nos. 6 and 7 contain the Journal of a Trip to Balasore and Cuttack, and relates to the Canals and Bridges proposed to be constructed in that District.

The Bound Book contains a fair Copy of a considerable part of the above-mentioned Journals, but is not completed or corrected.

CALCUTTA,
28th April, 1825.

(Signed) T. M. TAYLOR,
Assistant Superintendent of Canals.

No. 35.

No. 109.

To LIEUT. PRINSEP,

Engineer.

SIR,

I am directed by the Canal Committee to request, you will favor them with your opinion on the following points, relating to the Canals carried on under your immediate Superintendence in the neighbourhood of Hoosenabad:—

1st. If these Canals would prove advantageous when completed, independently of the General Scheme for improving the Navigation between the Rivers Ganges and Hoogly.

2ndly. What local advantages are likely to accrue from completing them?

3rdly. If the completion of them would afford data to form a judgment of the practicality or difficulties to be anticipated in the execution of Major Schalh's Plan generally, by shewing the action of the Tides in them in forming deposits, or in acting upon their sides.

4thly. At what expense the Cuts might be completed ?

On these points the Committee flatter themselves with the hope of receiving the most satisfactory information from you, being well aware of the opportunities you had on the spot of acquiring the fullest and most authentic information from the best sources.

I am, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
3rd November, 1825.

(Signed) T. M. TAYLOR,
Officiating Secretary, Canal Committee.

No. 36.

No. 111.

TO THE PRESIDENT AND MEMBERS OF THE EMBANKMENT COMMITTEE OF THE 24-PERGUNNAHS.

GENTLEMEN,

Under instructions from Government in the Territorial Department, dated the 6th instant, I am directed by the Canal Committee to submit the following subject connected with the Proposed Plan for improving the Navigation between the Rivers Hooghly and Ganges, for your consideration and opinions.

1st. If the Cuts, commenced by Major J. A. Schalh, late Superintendent of Canals, &c. would (if completed) be useful independently of the General Scheme for improving the Navigation of the Sunderbuns. The first of these Cuts connects the Jabuna or Esamutty River and the Dansarkhal, commencing at a point on the former about 4 miles South of Bagundee near Hoosenabad, and running in a Westerly direction about seven furlongs. The second is to connect the Chanpoorkhal, or Kyoutullah, Doamya and the Gobrahal, commencing on the former immediately opposite to the mouth of the Dansarkhal, and running in a South-west direction 1 mile and 2 furlongs.

2ndly. The expense at which these Cuts could be completed should the measure be deemed advisable, and

3rdly. If the work might not be executed under the Superintendence of the Officers in charge of the Embankments in the 24-Pergunnahs; or what other temporary arrangement might be adopted to effect the object in view with most advantage.

To elucidate the subject proposed for consideration, I have the honor to forward a Sketch, shewing the General Plan of the Canals through the Sunderbuns, and also a Plan with Sections of those which have been partially executed. They will assist you in forming an opinion on the advantages to be derived from the Cuts, and what yet remains to be done to complete them.

It is requested that the Sketch and Plans be returned to this Office.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
4th November, 1825.

I am, &c.
(Signed) T. M. TAYLOR,
Officiating Secretary, Canal Committee.

No. 37.

No. 120.

To CAPTAIN TAYLOR,

Secretary to the Canal Committee, Calcutta.

SIR,

I have to acknowledge the receipt of your Letter, No. 109, of the 4th instant, and shall be most happy in furnishing every information in my power relating to the Canals, in the success of which I have naturally imbibed a lively interest.

2. The Committee must be aware, that upon a subject involving so many intricate points, a prompt answer would be unsatisfactory. I have to request the favor of some delay to allow of a more mature consideration of the subject, and to allow a reference to Plans and Documents relating to the subject, none of which are at present with me at my Station of Chittagong.

3. The Committee would likewise confer a favor upon me, by transmitting a few Documents and Surveys [some my own] of which I have not kept Copies. A List shall be forwarded of those that appear most essential, and the Documents returned to the Office. I have likewise to suggest the advantage that would accrue by my personally visiting the seat of former operations at Hosseinabad, to ascertain the present state of the work left unfinished after the season, May 1824. Several circumstances may be elicited in observing the action of the Tides in the unfinished Cuts, which would greatly influence any opinion upon the success of the Canals. The Committee will, I trust, at once see the necessity of the visit, and with their concurrence, I will, when the opportunity occurs of there being no pressing business upon my hands, as Executive Engineer of a District, obtain the necessary leave for a month to perform the duty.

4. I have further to request to be informed with regard to the questions forwarded in your Letter, whether any other than the two Cuts, to which the operations were limited in 1823-24, may be considered as included, or whether the whole Cuts between Hoseinabad and the Salt Lake are intended. The junction of the Lake with the Hoogly at Chitpore, from which Major Schalch expected that the principal advantages were to accrue in the re-sale of the Land, &c., involves many questions of great nicety, and as I have not at any time been privy to the proceedings of the Committee in purchasing the ground, and am not aware that any very accurate Survey of the ground has been made, I could not immediately speak to the detail of that most important part of the Scheme.

5. The Committee are, I conclude, aware from previous correspondence, that many parts of the Line East of the Esamuttee River, are still very imperfectly Surveyed, and that the General Scheme of the Canal still requires much patient investigation, before any very accurate estimate can be formed of the real expense, or a very particular idea formed of the several minutiae of the Scheme.

EXECUTIVE OFFICE,
CHITTAGONG,
13th November, 1825.

I have, &c.
(Signed) THOS. PRINSEP,
Ex. Engineer.

No. 37. a.

List of Documents to which I have to request to be allowed to refer.

My general Survey of the Line from Hoseinabad to the Beharee Nullah.

My Sketch of the Salt Lake and Environs.

The late Major Schalch's detailed Estimates, of which I have never obtained a Copy.

An abstract account of the Expenditure upon the Hoseinabad Canal in 1823-24.

TO CAPTAIN TAYLOR, *5th Cavalry,*
Officiating Secretary, Canal Committee's Office, Fort William.

No. 38.

CAPTAIN T. M. TAYLOR,

Secretary, Canal Committee.

SIR,

In compliance with the wish of your Committee, communicated to us on the 8th July last, we have now the pleasure to submit an Estimate, shewing the expense of a single Rail Road, including Engine, Waggon, &c. from the Circular Road to the Balliaghaut.

As this Estimate exhibits also the cost per mile on a strait line, the probable expense to Diamond Harbour may easily be calculated when the distance is known.*

We have likewise the pleasure of furnishing herewith a Plan, which will give an idea of the Rails, Waggon, &c. and the manner of laying down.

We take the liberty to enclose a Report and Estimate which were laid before a Committee in England; in it you will find fully enumerated all the advantages which this mode of conveyance possesses over every other; it is therefore unnecessary for us to repeat them.

We have to apologise to the Committee, that so much time has been permitted to elapse since the order was received, but the very unsettled state of the weather, added to several other circumstances, prevented us from commencing on the measurement of the Board, and we trust the delay will not be imputed to negligence.

We are, &c.

CLIVE STREET,
11th November, 1825.

(Signed) JESSOP AND Co.

* About 26 miles from Kidderpoor Bridge to the Godowns.

(Signed) T. M. T.

No. 38. a.

Each Railway being 3 feet long and 5 lbs. weight, and 2 ways being required to each yard, one mile in length, will weigh about, 88 Tons.

88

22 £ per Ton.

£ 1,936 for Railways in 1 mile.

250 Nails.

2,186

For the Diamond Harbour	Exchange at 2/1 per Rupee,	21,860
Road the Estimate will be	...	...
57,860 × 26½, Sa. Rs. 15,23,290	Blocks, Piles, &c.	30,000
Turnings and Wharfings, .. 55,000	Common forming, &c.	6,000
Locomotive Engines, 24,000		
30 Waggons, 18,000		
		<hr/>
16,20,290	Each mile of Railway fitted,	57,860
Contingencies at 20 per cent. 3,24,058		<hr/>
Sicca Rupees 19,44,348		
	The distance from the Circular Road to the Salt	
Without reference to the expense of	Water Lakes is 2.55 miles, Rs. 57,860 × 2.55, 1,47,543	
New Bridges.	Ten-horse Locomotive Engine,	12,000
(Signed) T. M. TAYLOR.	15 Waggons, 3 to 4 Tons each, at 600,	9,000
Turnings, Wharfings, &c. ...	...	55,000
		<hr/>
		2,23,543
Contingencies at 20/ per 0/0 .. ..	...	44,709
		<hr/>
		2,68,252
		<hr/>

(Signed) JESSOP AND CO.

No. 39.

(No. 113.)

To H. MACKENZIE, ESQ.

Secretary to Government in the Territorial Department.

SIR,

Pursuant to the instructions contained in your Letter, No. 609, of the 30th of June last, I have the honour to forward, by order of the Canal Committee, a Copy of a letter which has been received from Messrs. Jessop and Co., with the Plan and Estimate of the expense of a Railway from the Circular Road to Ballia Ghaut, amounting to Sicca Rupees 2,68,252, and also the expense of a Railway for one mile, by which that to Diamond Harbour may be ascertained.

As the distance from the Kidderpore Bridge to Diamond Harbour by the Road is about $26\frac{1}{2}$ miles, the expense of a Railway, according to Messrs. Jessop and Co.'s Estimate, and including that of 2 Engines and 30 Waggons, together with Contingencies, will amount to about 19,44,348 Rupees.

CANAL COMMITTEE'S OFFICE,

CALCUTTA,

16th November, 1825.

I am &c.

(Signed) T. M. TAYLOR,

Officiating Secretary, Canal Committee.

No. 40.

To LIEUTENANT TAYLOR,

Acting Secretary to Canal Committee, Calcutta.

SIR,

We have the honor to acknowledge the receipt of your Letter, under date the 4th instant, requiring us to state our opinion, whether certain Cuts commenced by the late Superintendent of Canals would, if completed, prove useful independently of the general schemes for improving the Navigation of the Sunderbuns, and whether the work might not be advantageously executed under the Superintendence of our Committee.

2d. On the first of these points, we beg leave to express our opinion, that no advantage whatever would be gained by connecting the Juboona River with the Dansarkhal, and the Kyontullah Doonya with the Gobra Khal independent of any other Cuts, on the following grounds:—That Boats before they could enter the Cuts in question from Calcutta would still have to pass through the Attarah Banka, which it was one great object of Mr. Schalch's Plan to avoid, and because, after quitting the Attarah Banka to reach the New Canals, they would still have to pass through as much Jungle as they would encounter were they to proceed to the Juboona by the usual route; while, to Boats, which have afterwards to pass through Goodlad Creek to the Eastward, the distance by the former route would be considerably greater than by the latter. The New Cuts might perhaps obviate the delay to which Boats are at some seasons subjected by adverse winds at the junction

of the Roymungul and Burra Coolea ; but as this delay is seldom expected till it has been actually experienced, it is doubtful whether Boats would often choose what is apparently the more tedious route, for one which may only become so by adventitious circumstances.

3d. On the second point, we have to remark, that the distance between the station of Jessore and the New Cuts is not less than fifty miles, while from Calcutta it is considerably less, and that the collections of the revenue from the adjoining Lands is made by the Commissioner in the Sunderbuns, while the administration of justice is in the hands of the Judge of the Twenty-four Pergunnahs and the Joint Magistrate at Barraset. On these grounds, we conceive, supposing Government should resolve upon executing the work, that it could not be advantageously Superintended by our Committee, and in the event of a separate Officer not being appointed for that special duty, that it could not be Superintended so efficiently as by a Committee resident in Calcutta.

4th. The Plans, which accompanied your Letter, are herewith returned.

We are, &c.

ZILLAH JESSORE,
COMMITTEE OF EMBANKMENTS,
The 28th November, 1825.

(Signed) R. W. MAXWELL,
Acting 2nd Member.
,, D. DALE,
Acting Member.

No. 42.

TO CAPTAIN T. M. TAYLOR,
Officiating Secretary to Canal Committee.

SIR,

We have the honor to acknowledge the receipt of your Letter, dated the 4th instant.

2. As we are not informed of the particular objects of the Excavations proposed to be made between the Esamotee and Dhansar Khall and the Chundpoor and Gobra Khall, we feel ourselves incompetent to judge of the usefulness of the work, but as the measure was proposed by the late Major Schallch, and the work with the sanction of Government actually commenced by him, we are naturally led to suppose, that so able an Officer as Major Schallch could not have recommended, or the Government have sanctioned, the measure unless convinced and satisfied of its utility.

3. On the 2d point referred to our notice, we beg to state, that we have no experience to guide us in forming even an Estimate of the probable expenses of the undertaking, and therefore feel diffident in offering any opinion on the subject.

4. On the last point of reference, we have to inform you, that the places at which the Canals are proposed to be excavated, are not situated on the District in which our authority as a Committee of Embankments extends, and that if they were included in it, we are of opinion the present duties of the Superintendent would not allow of his giving his time and attention to so extensive an undertaking.

5. The Plan and Sketch are herewith returned.

We have, &c.

BARRIFORE
EMBANKMENT COMMITTEE,
24-PERGUNNAHS,
The 16th November, 1825.

(Signed) T. PLOWDEN,
Acting Collector.
,, R. H. SCOTT,
Judge and Acting Magistrate.

No. 43.

SIR,

Your Letter No. 115, with its enclosures, has been received, and I proceed to the several questions of your former Letter, No. 109, upon which I can the more readily enter after your explanation in the last paragraph.

2. Both the Cuts are, I expect, fully accessible to the Tide, although unknown to the Committee, as inferred from your Paragraph 3d. The opening at C. 1 Cut, or the Hoseinabad Canal, was effected by Major Schalch, before leaving the spot in May 1824, and I have little doubt, that the Tide has opened already more than one entrance into No. 2 Cut, or Bayley Gunge Canal.

3. Before entering upon the questions direct, I have to submit a few preliminary observations.

4. The Cut No. 1, closed against the River at A, now brings the Salt Tide within 180 feet of the fresh water of the Eshamuttee River under circumstances, observations upon which would at once determine the practicability and advantage of admitting the Salt Tide into that River, and likewise suggest the method necessary to be adopted; such observations are highly desirable, and have not as yet been procured within my knowledge. The result of many of my own successive observations* from January to April 1824, created apprehensions to be entertained from the result of its admission, and in consequence, the measure of closing the head of the Western branch of the † Hoistullah Avanya [Kyontullah Doanya] below the origin of the 2nd, or Bayley Gunge Cut at X, (vide Plan No. 1,) formed a part of Major S.'s scheme, which was I believe communicated to the Committee.

5. The expense of this Bund will be considerable, from the large section of the water-course, and its position will detract a trifle from the advantages (in point of communication) to be derived from opening the two Cuts, without prosecuting the series to the Chowmook Khal and Salt Lake; inasmuch as it lengthens the course by $8\frac{1}{2}$ miles to the Gottyahara Point, an entrance into the old Attara Banka passage.

6. Two rainy seasons have passed since operations were suspended upon the work, and much may have taken place greatly to the detriment of the undertaking, (in the falling of the banks, &c. of these Cuts) which has neither been attended to, nor reported.

7. The Committee will therefore fully understand my anxiety for a personal inspection of their present state.

8. I have further to remark, that the actual expense incurred upon the two Cuts will, I trust, greatly exceed what may be assumed, as a Standard for the rate of future operations under careful management. The experience gained (certainly at some loss) by the late operations in carrying the Canal through Jungle, at the same time that it establishes the perfect possibility of the undertaking, has suggested many points to be attended to in the economy of the execution of this part of the scheme. The operations upon No. 2 Cut were in every way unlucky. The late period at which the contracts were entered into, sickness, mortality, and general disgust at the nature of the work, created the evil desertion to such an extent, that the Contractors, who brought their Coolies from 20 to 40 miles inland, could not perform their engagements, save with the certainty of loss. Their subsequent chicanery at the time of closing the proceedings, was the result of their expectation of loss, and hence the large Balance outstanding against them. The same thing could not have happened, were operations limited to cultivated country, or if sufficient means

* Upon the relative advent of the Salt and Fresh Tides, and their levels (simultaneous) at different times.

† A term I believe peculiar to the Sunderbuns, meaning a Khal, divided into two branches of equal magnitude, and only applied as in this case, to the termination of the Salt Creeks, where they are met by cultivation.

were provided for the comfort of the Coolies, who must necessarily be strangers, as the Salt Districts yield few or no hands available in an extensive undertaking.*

I would therefore earnestly suggest that, if any future prosecution of the works is anticipated, the assistance of the Commissioner in the Sunderbuns should be solicited, and his attention called to the advantage that would accrue by cleaning and bringing under cultivation the particular tracts of Jungle through which the Canal has to pass.

10. I speak from personal experience, when I affirm, that many applicants would readily engage on the Jungle Potta terms, to settle on the spots in question; and I think the Commissioner will agree with me in anticipating its advantages to the Canal in point of saving, even should it be necessary to grant a bonus by way of remuneration to any successful clearer.

11. I now proceed to the several questions of your Letter No. 109, successively:—

Question 1st. Whether the Canals would prove advantageous when completed, independent of the general scheme for improving the Navigation between the Rivers Ganges and Hooglee?

Answer. Advantageous in point of any revenue to be derived, certainly not. The only preference they can offer to Morrieson's Cut and the Bura Koolya Passage [is] in the escape from the celebrated Roymungul corner, only dangerous during the S. W. monsoon to ill-found Boats. The advantage is purchased by lengthening the route, and I should fear that few Native Boats would consider their advantage worth even a trifling Toll. The Gottyahara Khal, by which they will still have to pass into the Attara Banka Passage, is one of considerable dimensions, and its course N. and S., exposed to the fury of the Monsoon. The danger is, however, less than at the Roymungul corner.

The series of Cuts, unless followed beyond the Chowmook to communicate with the *Tarda Nulla*, or Salt Lake, can offer no chance of being productive as a thoroughfare.

Again. It may become a necessary, and therefore advantageous, measure, to effect the opening of the Hoseinabad Cuts, in order to prevent their being rendered perfectly useless hereafter, from sediment left by the receding Tides in their bed, or by the falling in of their banks, which were Cut at too steep an angle (45°) to ensure permanency.

This point and the method to be adopted in effecting such opening, is only to be ascertained by a Survey of their present state.

Question 2nd. What local advantages are likely to accrue from completing them?

Answer. The previous observations will have apprized the Committee, that as apprehensions may naturally be entertained of even local disadvantage, it will be necessary to allay these by careful observation upon the subjects pointed out in Paragraph 4 of those remarks, from which data may be obtained to determine all doubt.

I consider the alarm raised among the Salt Manufacturers near Hoseinabad in consequence of Major S——'s determination to close the head of the Kulloor Gang, below the origin of the Bayley Gunge Canal, as groundless; and if this part of the scheme be carried into effect (Observation at A. of No. 1. Cut will determine whether it is indispensable,) the apprehension from the admission of the Salt Tide into the Eshamuttee will fade considerably, if not entirely disappear.

Some local advantage may be afforded to any, who may settle for purposes of cultivation in the vicinity of the Jungle line of the Canal, by the facilities offered by the mound of Exca-

* Some reasonable hope may even now be entertained of recovering some of these balances by pursuing the work, if the cases which were opened in the Courts produce nothing.

vation to clearing and bunding operations. The present disputed rights of property in the Jungle Land render, however, the chance of settlers availing themselves of these advantages uncertain.

Any other advantages to the prosperity of the neighbourhood will of course be limited, from the smallness in extent of the cultivated country immediately concerned.

The local advantages I should therefore say were not considerable, and of rather a general nature; all apprehension of disadvantage may, I think, easily be met by a little care and investigation.

Question 3rd. If the completion of these would afford data to form a judgment of the practicability, or difficulties to be anticipated in the execution of Major S——'s Plan generally, by shewing the action of the Tides in them, in forming deposits, or in acting upon their sides?

Answer. The completion of these Cuts, the management that observation may dictate, and the experience to be gained from their result when completed, will furnish data most indubitably for nearly every case likely to occur between the Salt Lake and Koolna, and must therefore be desirable.

With regard to the question in the more limited view, in which it may be taken literally, it is quite evident, that any Cut under the circumstances of No. 1, must become subject to corrosion of its banks during the Freshes of the River. The extent of such corrosion will no doubt be determined by the completion of the Cut.

Again, with regard to No. 2, in case the Bund at X should not become indispensable in opening No. 1 into the Eashamuttee, as the points A and B of No. 2. are equidistant from the bifurcation of the Keontulla Doanya, and therefore the advent of the Tide simultaneous, it is to be feared that the Tide will meet in the centre of the Bayley Gunge Canal, and, under the most unfavorable circumstances, as the Cholkoonnee Sand Bank, (which we found it impracticable to pierce below the depth of 7 feet,) must become the point of collision. This care, or a modification of it, must be of most frequent occurrence in the series of Cuts. The bund at X, if made, will of course annul the objection, and may contribute still further to the advantage of the Canals by ensuring a set of Tide, which it is highly desirable should be uniform, even as far as the Bairmaree Khal or Chowmook. It may likewise furnish the opportunity of diminishing the enormous expense required to empty and complete the Excavation of the 2d Cut,* by affording the possibility of introducing a current of water during the Freshes from the Eshamuttee.

The once apprehended impossibility of carrying a Canal through uncleared Soonderbun Jungle, under water every Flood Tide, has already been met by the late operations, and its perfect feasibility established. A point of still more consequence to the success of the undertaking will be placed beyond a doubt, if the junctions of the Salt and Fresh Tide at Hoseinabad is so managed, as to obviate all fear to the beautiful cultivation along the banks of the Eshamuttee, or injury in any way to the prosperity of the vicinity. Three or more Cuts made, —exactly parallel circumstances must occur between Hoseinabad and Koolna. Every attention, and the most careful observation, should be paid to this most essential desideratum.

Question 4th. At what expense the Cuts might be completed?

Answer. The Committee can hardly expect an Estimate of any correctness, of what is required to complete a work of the present state of which I am uninformed.

I can however point out to them, what are likely to be the probable objects of expenditure.

* Now only excavated to Low Water mark—in some places not that.



1. Clearing four furlongs of the Dansar Khal of roots, and deepening the Channel.
2. Completion of its Tracking Path, and the building several rustic Bridges over Nullas not fordable that cross the path.
3. Opening 180 running feet of Excavation towards the Eshamuttee at A.

4. The Embankment or Dam, for closing the head of the Kullour Gang at X, if necessary.

5. The completion of No. 2 Cut, either by emptying the water and excavating, or otherwise as circumstances may point out.

The two first are not likely to exceed 1,000 or 1,500 Rs., if any means of Dredging are provided. Dredging Boats

formed a necessary part of Major Schaleh's scheme, but I am uninformed if any are yet at the disposal of the Committee.

The Third Item I should hope could not exceed 1,000.

The necessity of the Fourth Item is as yet not absolute. The largeness of the section will render piling in deep water necessary; there will at no time, however, be any great difference of level in the water on either side of the Bund; I estimate it at from 5 to 8,000 Rs.

The Fifth Item may even reach the full amount necessary for a New Canal of the same depth. I hesitate to say what I think probable, as I consider that there is a chance of creating a Channel by other means.

In the foregoing answers, the Committee will, I trust, make due allowance for the degree of restraint under which they have been thrown together, from the circumstance of my not having visited the work since April 1824, when sickness drove me from Hoseinabad.

If my avocations in this District allow me the leisure, I shall in no way grudge either the trouble or expense of a visit to the spot, and if it is in my power then to contribute any thing further in elucidation of the several points, the Committee may rely upon my communicating it, as also upon my anxiety to gain the information, for my own satisfaction, at the earliest opportunity.

I have, &c.

(Signed)

THOS. PRINSEP,

Executive Engineer.

CHITTAGONG,
8th December, 1825.

The Plans forwarded shall be returned without delay.

No. 44.

No. 125.

TO HOLT MACKENZIE, ESQ.

Secretary to Government, Territorial Department.

SIR,

I am directed by the Canal Committee to acknowledge the receipt of your Letter of the 6th October last, and to express their regret at the delay which has taken place in replying to it, but which the enquiries necessary to be made by them rendered unavoidable.

2. In obedience to the orders of Government, contained in the 2d Paragraph of your Letter above alluded to, the whole of the arms and accoutrements, &c. which were deposited by Major Schaleh in the Iron Bridge Yard, have been returned by Captain Baker,

to the Arsenal of Fort William, and a receipt for them has been transmitted by that Officer to this Office for record.

3. On the subject of Outstanding Balances in the Canal Department, the Committee have no hesitation in admitting that Major Schaleh has left sufficient vouchers to establish the fact, that these are due from the Contractors to the amount of Rs. 16,451 : 0 : 4 $\frac{1}{2}$ as before stated, although they regret to add, that no part of these Balances has as yet been recovered. A Decree has however been obtained against the principal defaulter, (Pursoolah Mundle,) and a warrant for his apprehension is now in process of execution, which it is hoped will not only oblige him to come to a settlement, but have the effect of inducing others to follow his example; all other and gentler means having been tried and failed. Should the Committee be disappointed in this expectation, it is their intention to hand over a number of the Contractors, against whose names the largest Balances stand, to the Remembrancer and Superintendent of legal affairs, in order to the same steps being taken against them, as in the case of Pursoolah Mundle.

4. In reference to the 4th Paragraph of your Letter, the Committee became anxious to ascertain, how far the Cuts already in progress would be useful to the inhabitants of the surrounding districts, in the event of their being completed, independent of the general scheme of the Canal; and whether they could be finished according to Major Schaleh's Plan, at no very considerable expense. For the purpose of ascertaining these facts, letters were addressed to the Members of the Embankment Committees, both of the 24-Pergunnahs and of the Zillah of Jessore, as well as to ascertain from them, whether in the event of its being determined that these Cuts should be completed, the works might not be done under the Superintendence of the Officers in charge of the Embankments; or what other temporary arrangement might be adopted for the completion of the objects in view. From both of these Committees, I regret to say, that very unfavourable answers were received; and to enable you to furnish the best information to Government on these points, I am directed to transmit to you the originals of these Papers, with a request, that you will return them to this Office when no longer required.

5. Under the persuasion, however, that Lieutenant Prinsep could alone furnish accurate information upon the first two points in the 4th Paragraph of your Letter of the 6th October, namely, the partial usefulness of these Cuts, and the probable expense of their completion, the Canal Committee addressed queries to that Officer, nearly similar to those sent to the Embankment Committees, and have only within these few days received the reports of that Officer. After a careful examination of the information furnished by Lieutenant Prinsep, and the reasoning adduced by him, the Canal Committee are led to the conclusion, that it is only by an accurate Survey of the Cuts in their present or actual state, and report upon them, by some qualified person, that any definite opinion can be formed upon the propriety or otherwise of immediately completing them, as an experiment and fair trial of the general principles and merits of the Canal. To the Members of the Committee it appears of the first importance to ascertain this fact, and as Lieutenant Prinsep is undoubtedly the individual best qualified, from previous local knowledge, to undertake the Survey and Report in question, they take the liberty to recommend, that if that Officer's services can be dispensed with for a time at Chittagong, he be directed to proceed to the spot, and furnish the information so much desired.

The Committee are induced to suggest Lieutenant Prinsep as the most proper person, from the additional consideration that it appears very probable from his last Report, pages 5 and 6, that he would not consider it necessary to incur the large contemplated expense of closing the head of the Kullour Gong, or Kyontulla Doanya, by a Bund, and that he is now the only individual who is personally acquainted with the Contractors against whom the large Balances stand, or who could be expected to induce them to work out these Balances.

6. I have also been directed to transmit two Original Reports by Lieutenant Prinsep, together with the Plan alluded to in the latter of these, and to request that they may likewise be returned to this Office when no longer required.

I have the honor to be,

Sir,

Your most obedient servant,

C. K. ROBISON,

Officiating Secretary, Canal Committee.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
22nd December, 1825.

No. 45.

TO H. MONEY,
C. R. BARWELL AND } ESQRS.
J. MASTER, } *Canal Committee.*

GENTLEMEN,

Revenue, the 29th December, 1825.

I am directed by the Governor General in Council to acknowledge the receipt of your Acting Secretary's letter dated the 22d instant, with its enclosures, and to communicate as follows :—

2. Under the circumstances now stated, His Lordship in Council resolves, that the Estate of the late Major Schalch be relieved from responsibility for the Outstanding Balances of the Contractors, amounting to Rs. 16,451 : 0 : 4. The Military Accountant will be instructed to report the state of the account relative to the Military Stores.

3. It appears to be very desirable, that the places in the line of the Proposed Canal at which the unfinished Cuts have been made, should be surveyed at an early period by Lieutenant Prinsep, for the purposes stated by you ; and that Officer will accordingly be instructed from the Military Department to proceed to make the Survey at as early a period as the other exigencies of the Public Service will admit.

I am, &c.

HOLT MACKENZIE.

No. 47.

No. 23.

TO HOLT MACKENZIE, ESQ.

Secretary to Government, Territorial Department, &c. &c. &c.

SIR,

I have had the honor to receive and submit to the Members of the Canal Committee, your letter to my address of the 6th current, together with its enclosures.

2. I have been directed by the Committee to transmit to you, for the information of the Right Honorable the Governor General in Council, the following replies to the several points contained in Mr. Trower's letter, and the Report by the Tuhseeldar which accompanied it.

3. By a reference to Major Schalch's General Report of 19th October 1824, Par. 31, it appears that a distance of 3,320 feet, from the head of the Canal to the Bridge, had been excavated to the depth of $4\frac{1}{2}$, and average breadth of 65 feet. The expense of which amounted to Rs. 4,436 : 12 : 0, being Rs. 982 : 12 : 0, in excess of the Estimate submitted to Government on the 5th April, 1823.*

* *Deepening Canal.*

Amount Authorized,	3,454	0	0
„ Expended,	4,436	12	0
Excess,	982	12	0

4. The above extent of Excavation was all that was at that time conceived to be necessary to render the Navigation of the Canal free and uninterrupted; but to ensure its remaining so, Major Schalch recommended that a Channel should be formed through the Salt Water Lake, from the termination of the Canal at Balliah Ghaut to Bamingotta, by deepening the bed of a Nullah which forms a passage for the Tide from the Sunderbuns to the lower part of the Lake near the mouth of the Canal; the soil to be taken out, being so placed as to form a Bund on each side. By this mode of proceeding, the Tide would have been admitted, and Major Schalch anticipated that it would have the effect of scouring out the Canal, and likewise prove favorable to the great Eastern Canal, *of which indeed it formed a part*. The Plan proposed by Major Schalch was approved of, and he was directed to carry it into execution, at an estimated expense of Rs. 6,331.*

* Major Schalch's Letter, 5th April 1823.

5. The work had proceeded some way, when the exceeding slimy nature of the soil obliged him to desist, until he could prepare Dredging Machines, and when he had expended only Rs. 1,451 : 7 : 6 of Rs. 6,331 authorized by Government.†

† <i>Forming Channel through Lake.</i>			
Amount Authorized,	6,331	0	0
„ Expended,	1,451	7	6
	4,879	8	6

‡ <i>Total for Canal and Lake.</i>			
Authorized, .. Rs.	9,785	0	0
Drawn,	6,000	0	0
	3,785	0	0 being

Balance remaining in Collector of 24-Per-
gunnahs' hands.

6. The Marginal Statements exhibit the sums authorized, and the amounts drawn and expended in deepening the Canal, and in forming the Tideway or Channel through the Lake.‡

7. I have been also directed to transmit to you, a Sectional Plan of the Canal, upon which the Excavations executed by Major Schalch, are distinctly put down, and from which it appears to the Committee, that all the work which Major Schalch was directed to perform on the Canal itself, was completely finished; the further operation of forming a Channel through the Lake being rendered impossible by circumstances fully explained by Major Schalch at the time.

8. The Committee have further directed me to remark on the Report by the Native Tuhseeldar, that he was, in their opinion, at no time a proper judge of the works performed by Major Schalch; and that at the period of his Report to the Collector of Calcutta, the lapse of time since the cessation of these works must have rendered it very difficult for any one, much more so for a Native Tuhseeldar to decide, how far the task assigned to Major Schalch was completed, or proportionate to the expenditure, or sums advanced to him for the object in question.

9. The Committee regret that they cannot furnish any correct information on the present state of the Balliah Ghaut Canal, nor, unless the Government could state when they propose to resume the prosecution of the *Great Canal*, will the Committee have any grounds from which to form an useful opinion.

10. The Papers which accompanied your letter are herewith returned.

I have the honor to be,

Sir,

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
14th April, 1826,

Your most obedient servant,
C. K. ROBISON,
Officiating Secretary, Canal Committee.

P. S.—As the Sectional Plan transmitted herewith is an original, and there being no Copy of it in the Committee's Office, may I request the favour of your returning it when no longer required.

C. K. R.

No. 48.

To H. MONEY,
C. R. BARWELL AND } ESQRS.
J. MASTER, } *Canal Committee.*

GENTLEMEN,

Revenue, the 4th September, 1826.

I am directed by the Vice-President in Council to transmit to you a Copy of a letter from Lieutenant T. Prinsep, of Engineers, reporting his arrival at the Presidency. Lieutenant Prinsep has accordingly been directed to place himself under your orders, and His Lordship in Council requests that you will issue to that Officer such instructions as you may consider proper, with a view to the active prosecution of the important works upon which he has been directed to be employed, as soon as the season for active operations commences.

2. You are requested to report, for the information of Government, the amount of Salary and other Allowances, which with reference to the nature and importance of the duty entrusted to him, it will be proper to assign to Lieutenant Prinsep, in addition to his Military Pay, but without other Military Allowances.

I am, &c.

E. MOLONY,

[*Acting Secretary to Government.*]

No. 49.

No. 82.

To LIEUTENANT T. PRINSEP,
Superintendent of Canals.

SIR,

In conformity with the Orders of Government, I am directed by the Canal Committee to request you will do them the favour to state, what Plan you propose following in the execution of the work entrusted to you during the ensuing season.

2. It occurs to the Committee, that the primary object for your consideration and attention is the speedy construction of the Ooltadanga Canal, or that proposed to be excavated from the Balliaghaut Canal to Chitpoor; but as it would, in the judgment of the Committee, be impolitic to commence on this work before the whole of the Lands that may be required for it are purchased, and as some delay may unavoidably occur in effecting the whole of these purchases, the Committee are of opinion, that considerable advantage would accrue to the general execution of the Plan, were you to look to the necessity for an early preparation of suitable and well constructed Dredging Machinery, with receiving Boats and other apparatus, so essentially requisite to be used in the Salt Water Lake, and many other parts of the line between it and Coolna. The Committee therefore request, you will do them the favour to prepare a particular Estimate of the cost of such Machinery, Boats, and Appurtenances for submission to Government, bearing in mind that a proportion of such materials are already available, being lodged in the Yard of the Agent for Iron Bridges; a List of them is herewith forwarded, and Captain Baker will be instructed to make them over to you, and which it is apprehended might be usefully adapted to a Boat to be worked by Coolies.

3. The Committee would likewise wish to be furnished with detailed Plans and Estimates of the Ooltadanga Canal, with its Harbour, Locks, Dams, Site for Iron Bridges, &c., also to be informed as to the probable period of its perfect completion, should the required Lands be purchased and cleared away, ready for working upon by the month of June next.

4. The inspection and completion of the work left unfinished by the late Captain Schalch, are in the estimation of the Committee, points of very considerable importance; it would therefore be advantageous employment of your time, whilst the purchases are carrying on of the Lands required for the Ooltadanga Canal, were you to examine the Hus-sinyabad and Bayleygunge Canals, and their continuation to Cheltaberriah, and concert measures for executing the work as speedily as possible. The Committee could wish at the same time, to be favored with a Report from you, as to the best method to be adopted, and the expense that will probably be incurred in the construction of the Dam proposed to be thrown across the Kullooar Nullah, and upon the expediency or otherwise of constructing such Dam.

5. The surveying and marking out of the different Cuts, between the Esahmuttee River and Coolna, can be done during any interval of leisure that may occur in the course of the operations of the approaching season; but the Committee remark, that no Excavations should be attempted throughout those proposed Cuts, until considerable progress has been made in the construction of the Ooltadanga Canal.

6. The Committee request, that the points herein specified may be maturely considered by you, and in the event of its appearing hereafter to be requisite in your judgment that any modification of the Plan of operations laid down in this Communication would be desirable, you will of course submit, through their Secretary, your sentiments respecting such alterations.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
19th October, 1826

I have &c.
(Signed) J. N. JACKSON,
Secretary, Canal Committee.

No. 50.

TO MAJOR J. N. JACKSON,
Secretary to Canal Committee.

SIR,

Revenue, the 9th October, 1826.

I am directed by the Vice-President in Council, to acknowledge the receipt of your Letter dated the 25th ultimo, and to request, that you will inform the Committee, that His Lordship in Council has been pleased to authorize Lieutenant Prinsep, to draw a Salary of 1,000 Rs. per Mensem, exclusive of his Military Pay as recommended by them, to have effect from the 1st instant: and to entertain the Establishment specified in the margin* at

* 1 Sircar,	25
1 Writer,	30
1 Tindal,	6
10 Clashies at 5,	50
Stationery, Instruments, &c.	100

an expense of Rupees 211 per Mensem.

2. His Lordship in Council does not deem it expedient to fix the allowance for Boat Hire and Travelling Charges to be drawn by Lieutenant Prinsep, and desires that he may submit Contingent Bills for sums actually disbursed by him for such

Total 211

purposes, charging the usual rate of Boat-hire for any Boats that may be his own property, whilst they are actually employed on the public service.

3. The Committee were, by the orders conveyed in my letter of the 14th ultimo, requested to issue such instructions as might seem necessary to Lieutenant Prinsep. The correspondence, however, which has passed with the Board of Revenue, relative to the obstructions reported to exist in the Eastern Canal, as well as Mr. Acting Secretary Robison's letter of 14th April last, the receipt of which is hereby acknowledged, having again come under consideration, I am further directed to communicate to you, for the information of the Committee, the following observations relative to the immediate operations to be conducted by Lieutenant Prinsep :—

4. The Eastern Canal being a work of the greatest importance, both from its admitted utility and the return which it is expected to yield for the sums expended on it, will of course claim the earliest attention of the Committee : adverting, however, to the Orders which have been received from the Honourable Court of Directors on the subject of this work, His Lordship in Council considers it proper to direct, that the further progress to be made in it shall for the present only extend to securing the Land which may be requisite to ensure its ultimate completion, when the numerous advantages of the work which have been submitted to the Honorable Court shall, as is confidently anticipated, have induced them to give their full sanction to the undertaking.

5. To suspend entirely all measures connected with this Canal, would indeed not only amount to a sacrifice of a considerable portion of the money which had been laid out on it before the Orders of the Honorable Court were received ; but as Land in the vicinity of Calcutta is daily increasing in value, the Canal could not ultimately be completed for the sum originally estimated ; and although it is not desirable that any considerable sums shall be disbursed immediately, in furtherance of the general object, yet there seems to be little doubt that the purchase of the Land required, while it can be obtained on reasonable terms, will in the end be productive of no small advantage, particularly as it seems probable that the Land purchased can easily be let to individuals for the purpose of brick-making, thereby yielding a small rent, and ultimately reducing the labor and expense of excavating the Canal, when the work can be actively prosecuted.

6. But even if the Honorable Court shall consider it expedient to direct, that the Canal shall be altogether abandoned, His Lordship in Council has no doubt, that any Land which may be purchased with a view to the completion of the work, can easily be resold at a price equal to, if not higher than, what it can now be purchased for ; and therefore there does not appear any ground to apprehend an ultimate loss, even in such a view of the question.

7. Under these circumstances, the Committee are requested to ascertain and report to Government, the extent of Land which will be required for the completion of the whole line of Canal to its junction with the Hooghly, as well as the terms on which it can be purchased ; and in carrying this arrangement into effect, the Committee are requested to adjust the price to be paid for the different parcels of Land in such a manner, as to render the disbursement on account of it as gradual as may be consistent with the object in view.

8. In regard to the immediate operations to be undertaken by Lieutenant Prinsep, His Lordship in Council conceives, that Officer may be usefully employed in removing the obstructions stated to exist in that part of the Eastern Canal already open, and in deepening and bunding the Channel which was proposed by Major Schalch, through the Salt Water Lake, as described in the 4th Paragraph of Mr. Robison's letter above adverted to, so as to render the whole line from the Sunderbuns completely navigable.

9. Of the sum already authorized for the above purpose, there still appears to be a

Balance in the hands of the Collector of 24-Pergunnahs, amounting to Rs. 3,785, upon which the Committee will be authorized to draw, and they will of course report to Government in regard to the further advances, which may be required to complete the work.

10. It will at the same time be advisable that Lieut. Prinsep should examine and report upon the actual state of the Hussingabad Canal, in order that such repairs may be made to it, as will prevent injury to the part which has already been excavated.

I am, &c.

[Signed E. MOLONY,
Acting Secretary to Government.]

No. 51.

(Copies.)

No. 2.

To CAPTAIN J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

1. I have the honor to acknowledge your letter No. 82, of 19th instant, and in reply, have to offer the following observations upon the several points therein enumerated :—

2. With respect to the Ooltadanga Canal, as the period of its commencement must depend upon the proceedings of the Canal Committee in purchasing the ground, (upwards of $\frac{2}{3}$ ds of which remain to be effected,) I cannot hope to be allowed to include it in my general scheme of operations during the ensuing season. It will be almost unnecessary I believe for me to state my conviction, that the ultimate pecuniary advantage to be expected from the Scheme of the Canal, depends mainly upon this, its most essential part, and to remind the Committee, that the later its execution, the more distant will be the prospect of any return whatever.

3. The detailed Plans and Estimates which I propose during the season to prepare and submit to the approbation of the Committee for this part of the work, in which I intend the introduction of several alterations from Major Schalch's original Scheme, both improving and economising the work, will, I have no doubt, be received with approbation. I may hereafter have the honor to submit to their consideration, the propriety of boring during the present season, to discover the nature of the soil where Bridges or Rivetments of any kind are to be constructed, in order to create greater accuracy in the Estimates.

4. I now have the honor to submit what I consider to be the most adviseable general scheme of operations for the present year, from which I exclude the Ooltadanga Canal for the above reasons; although, should the Committee conceive it possible to assign any portion of the ground for this year's excavating, (even $\frac{1}{2}$ a mile,) I should judge it adviseable to commence the excavation of so small a portion, even should it be necessary to abridge the present scheme for the purpose.

5. Major S.'s operations in the Salt Lake have already pointed out the impossibility* of clearing a Channel through it, by any other means than Dredging.

6. I therefore propose immediately to fit up, in the most economical manner possible, the frame and buckets now in Store. The Machinery may be erected upon two Native Boats of 500 or 600 maunds burthen, and smaller Boats of the country may be made use of, for carrying away the mud. I enclose a memorandum of what I estimate will be the expense of this

* Vide his Report
of 19th October
1824.

measure, which if successful, may be enlarged upon by the construction of a strong flat-bottomed Boat for the purpose. As there are not sufficient cog-wheels in Store, and no shafts or gudge on steps for any part of the Machine, it may be necessary to have recourse to Messrs. Jessop and Co., or other ironmongers, to make up the deficiency. My Estimate is therefore liable to some uncertainty on account of their rate of charges. As I can, however, construct the principal part of the work under my own eye in Captain Baker's Iron Bridge Yard, (unless that Officer's work would be inconvenienced by my so doing,) I am in hopes the Machine will cost even less than this Estimate.

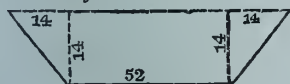
7. In conversing with Mr. May, the Superintendent of Rivers, I anticipate the possibility hereafter of arranging with that gentleman for the use of his Dredging Apparatus for three months during the year, an arrangement that cannot be viewed otherwise than as advantageous and economical to both undertakings. The Committee will, however, I have little doubt, see the necessity and advantage of making some use of the Machinery in store, especially if an early trial can be made of this method of Excavation, (which is likely to be resorted to in so many instances,) at a small expense.

8. The line of Canal which in my opinion should occupy the attention of the Committee during the ensuing season is, the series of Cuts from Hoseinabad to Chultabarya and the Salt Lake, with the completion of those left unopened.

9. I have already visited the Hoseinabad and Bayley Gunge Canals. The former has suffered from the sliding of its Banks, by which 4 to 5 feet of its depth has been filled up.

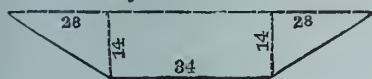
MAJOR SCHALCH'S SECTION.

80 ft. total breadth.



PROPOSED NEW SECTION.

90 ft. total breadth.



The slope given to the Banks was evidently too great (45°) and I would earnestly advise an alteration as per margin in the section for Excavation. This filling up is not of material consequence, inasmuch as there will be more than sufficient current when the water is admitted from the Eshamuttee River to clear it out. The Bayley Gunge Cut is in nearly the same state as when left in 1824. During my visit in September, there was 5 feet average of water, and as the Tide had access from its Western extremity, it would be left in general dry by the Ebb

Tide of the present month, but for certain obstructions across its Channel. It will therefore be possible to continue its Excavation to the full depth, except for a short distance where oozing sand has been discovered. The Dam at X. mentioned in my former communication of 8th December, 1825, will, I expect, still be found necessary, and as I may expect that its accomplishment might render this expensive method of finishing the Bayley Gunge Cut unnecessary, I shall at present not offer any distinct Plan of proceeding relative to this part, until a few more visits to the spot enable me to submit something more satisfactory on the subject.

10. I propose, if the Committee approve, to employ Coolies, (Hillmen if possible,) in clearing the Jungle and excavating two parallel Ditches of $3\frac{1}{2}$ to 4 feet depth, one to denote each side of the Canal and furnish earth for the formation of a bund of enclosure along the remaining $5\frac{1}{2}$ miles, from the Western extremity of the Bayley Gunge Cut, to the proposed junction with the Chowmook Nullah. This method, which will cost from 1,000 to 1,500 Rs. per mile, will be found very advantageous, as preparing the ground for Excavation during the following season.

11. I propose further, as this would occupy very little of my time, to survey and excavate by contract during the present season, the Cut of $1\frac{1}{2}$ mile sanctioned between the Chultabarya Nullah at Gabtulla and the Bungur Nullah at Dara; I can prepare the ground for the contractors by December.

12. The several objects which I could undertake under my own personal supervision, with hopes of their completion during the season, are therefore as follows :—

First. The Dredging Apparatus and its trial upon the Channel through the Lake.

Second. A Cut of $1\frac{1}{2}$ mile in length from Gabtulla to Dara.

Third. The clearing, bunding and boundary Ditches of the line from Bayley Gunge to Chowmook, preparing the ground for excavation during the following year.

Fourth. Concerting proper measures for the completion of the unfinished Cuts, and if necessary, the construction of the Dam at X.

13. I hope the Committee will not consider the scheme too confined for the season's operations, and less than I could undertake, without assistance from European Overseers. Any interval of leisure will be employed in digesting the Plans proper for the Canal of communication between the Lake and River at Chitpoor, and in surveying the tract Eastward between the Eshamuttee and Coolna.

14. My operations would be greatly forwarded by the assistance of one or two European Overseers, if such could be procured; one to superintend the Dredging Machine, who must however already possess some knowledge of Mechanics, to enable him to prove at all useful. Another to superintend the Jungul clearing West of Bayley Gunge, and to be available in case the Dam at X is commenced upon this year.

15. I have to request that a copy of the list of Defaulters, with the amount of their Balances may be furnished me, as it may be in my power during the progress of the work, to recover some portion of the amount, and that sufficient funds may be placed at my disposal for proceeding with the whole, or such portion of the above scheme, as the Committee may finally authorize.

CALCUTTA,
SUPERINTENDENT OF CANALS OFFICE,
26th October, 1826.

I have &c.

(Signed)

THOS. PRINSEP,
Lieutenant, Engineers.

No. 52.

(Copy.)

No. 87.

TO LIEUTENANT T. PRINSEP,

Superintendent of Canals.

SIR,

I am directed by the Canal Committee, to acknowledge my receipt of your letter under date the 26th ultimo, together with the Estimate that accompanied it.

With reference to the orders of Government, and to the probable period that will be required for the final adjustment of the purchase of all the Land to be included in the line of the Ooltadangah Canal, the Committee are of opinion, that your earliest attention should be directed to the preparation of the Dredging Machinery, in the manner you propose, and on the Estimate submitted by you; at the same time the Committee, from past experience, wish to impress you with the urgent necessity of observing great caution and exactness in all engagements that may be entered into by you, with a view to the performance of this branch of the duty committed to you.

In the conclusion of the 6th Paragraph of your letter, it is observed by the Committee, that you proposed executing all your ironwork in the Yard of the Agent for Iron Bridges; the Committee see no objection to this Plan, provided it does not materially retard or interfere with Captain Baker's own operations, or inconvenience the progress of his works.

The detailed Plans and Estimates you have been called upon to prepare, the Committee conclude will be finished by an early period of the season, and that they will be transmitted, accompanied by such observations and suggestions as the course of experience may induce you to consider useful; the propriety of boring during the present season to enable you to observe the greater accuracy in the preparation of your Estimates, and to ascertain the precise nature of the soils where Bridges or Rivetments of any kind may be found necessary, is so obvious, that they are of opinion, no time should be lost in carrying that operation into immediate effect.

You will as early in the season as possible, attend to the completion of the series of Cuts from Husseinabad to Chaltaberria and the Salt Lake.

With regard to the operations you intend adopting in completing the Bayleygunge Canal, the Committee are prepared to authorize you to carry them into effect in the manner you have suggested.

The Committee are induced again to press on your attention, the necessity for entering into a minute examination relative to the expediency or otherwise of constructing the Dam at X, as noticed in your Report of the 8th of December, 1825, and will be highly pleased to find that a few visits to that spot shall have enabled you to furnish them with a full and satisfactory Report on the question in all its bearings.

The Committee are disposed to approve highly of the Plan suggested in the 10th Paragraph of your Letter now under reply, and beg that no time may be lost in carrying it into effect.

The Committee, I am directed to observe, are fully satisfied that you will avail yourself of every opportunity that may offer itself for expediting the operations of the Plan generally, during the season for active operations.

With regard to the European Overseers, required by you, I am directed by the Committee to observe, that whenever you are prepared to point out the source from whence they can be drawn, and the expense of entertaining them, the propriety of sanctioning that measure will be duly considered.

In conclusion, I have the honor to forward a List of Defaulters, with a specification of the amount of their several Balances, as required by you.

I have &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
3rd November, 1826.

(Signed) J. N. JACKSON,
Secretary, Canal Committee.

(True Copies,)

J. N. JACKSON,
Secretary, Canal Committee.

No. 56. b.

(Copy.)

Report upon the State of the Balyaghaut and Entally Canals.

1. The Entally Canal deepened in 1823-24, by Major Schalch, from 3 to 7 feet, has now scarce 4 to 5 feet of water throughout its course. The Balyaghaut Canal untouched by Major Schalch, has at present a mean depth of $3\frac{1}{2}$ feet: in some places only $2\frac{1}{2}$. The very short period in which the former of these Canals has become unservicable from the filling of its bed, induced me to observe more particularly the causes of such evil. The following are my views on the subject:—

2. Any operations in merely deepening the present Channel, would I fear, disappoint the Committee in their object of permanently securing the Navigation. The present section and nature of the Canal is defective in the extreme. Considerable alterations will be necessary before I can anticipate much satisfaction from the result of any measures for its improvement.

3. The influence of the Salt Lake creates a perfect stagnation in these Canals during the present and remaining dry months of the year; and the current during the rainy season rarely exceeds half a mile per hour at the extreme.

4. The present Banks are disposed at such an angle (greater than 45°), that it is impossible to prevent the continual crumbling of the bank from exposure to rain.

5. The Entally Nullah now forms the receptacle for all the Drains of the City, South of Boitaconna, and of some part even North of that Street; the rubbish and filth from these Drains; an occasional irruption of turbid River water from Tolly's Nullah by the Circular Road Drains; and the crumbling of its Banks, with the washings of the Cutcha Roads on each bank drained into the Canal, together, accumulate a mass of sediment which the tardy current of its water is not sufficient to carry away.

6. Hence, the cause of its continual choking. A perfect remedy for these evils cannot be easily furnished; because, in the first place, it would be disadvantageous, nay even dangerous to the Drainage of the City to allow of any alteration of the Nullah, which should create a rise in the level of the waters of the Canals, now barely 2 feet below **gill* of the Drain at the head of the Dhurumtullah.

7. The mean level of the Western end of the Lake, which now varies only 10 inches during the year, and which is affected not above 10 inches by Tides, must be assumed as below the general flood level of the Sunderbuns; it would therefore be highly injudicious to pursue Major Schalch's Embankments intended to follow the Canal through the Lake; as the influence of its body of water, now so useful in preserving the present level, would be destroyed by such measure.

8. To prevent any further injury from the crumbling of its Banks, it will be necessary to sacrifice 8 feet at least of the present road on each side to form a proper slope, which should be well sodded after its inclination is perfectly adjusted, and the roadway itself sloped gradually outwards, and not towards the Canal, as at present.

9. The space left would not suffice for a carriage road, the present roadway being narrow; it therefore becomes advisable to procure a narrow strip of ground in addition for the purpose: or otherwise to abandon the road on one side for the sake of the two slopes, and a good roadway on the other side.

10. The latter Plan will become difficult in the Entally Canal, which is provided with a road only on one side.

11. I am not at present fully prepared to offer to the Committee any Plan which would ensure the permanency of the Canal, or prevent its liability to suffer by many of the same causes of destruction that exist at present. I will however suggest, what I should recommend as actually necessary, and what appears to my judgment as the most advisable method of proceeding now in our power.

12. A portion of the Balyaghaut Canal East of the Bridge, will become part of the Canal of communication with Chitpore; it will therefore be highly desirous to execute this part of the work in the most effective manner, and I should hope the following scheme worthy of the attention of the Committee for this year's undertaking.

13. To deepen the Canal from the Coolya Bridge, to the Lake being $\frac{3}{4}$ mile in extent, to the full depth of $7\frac{1}{2}$ feet by Excavation.

14. As it is impossible to get rid of the water by Drainage where the Tide has so little influence, the whole length may be divided by Dams transversely into portions of conve-

Query, "the sill"
or "floor."
J. M.

nient length, to enable me to pump out the water of one or two portions in a few days. In this manner by excavating each portion in succession, commencing from the outer ends, I shall avoid the expense of pumping out the whole water in the Canal, besides leaving a certain portion always open in which Boats may remain.

15. I should also earnestly recommend my suggestion of giving the Banks of the whole extent of Canal, a better inclination. I however leave it to the judgment of the Committee to weigh the relative advantages of the two methods proposed in the 9th Paragraph. The first of these methods would certainly be preferable for that portion of the Canal, which will form a part of the grand Canal of communication.

16. The Channel through the Lake must be undertaken by Dredging Machinery, I need therefore not refer to it on the present occasion.

17. An abstract Estimate accompanies this Report of what I consider will be the probable expense of deepening the Channel and sloping the Banks, exclusive of any purchase of extra ground, which can be better estimated in concert with the Aumeen, now employed in making similar purchases by the Committee.

CANAL SUPERINTENDENT'S OFFICE,
November 20, 1826.

(Signed) THOS. PRINSEP, *Lieutenant,
Engineers.*

TO CAPT. J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

(A true Copy.)

J. N. JACKSON,
Secretary, Canal Committee.

No. 56. *b.*⁽¹⁾

(Copy.)

*Estimate of the Expense necessary to deepen the Ballyghaut Canal and
reslope the Banks.*

	Amount	Grand Total.
To deepening 30 feet mean width, to depth of 4 feet, throughout the Channel of 4,000 feet, length in all, 658 Chowkas, at 2/8. 	1,645 0 0	
„ Scarping the present Slopes to the East of the Bridge, Section on each side, estimated at 25 sq. feet, total length 4,000, in all 200,000 or 274 Chowkas at 2/4	616 8 0	
„ Sodding the Slopes, which at 11 feet width each Bank, for 4,000 feet, include 88,000 sq. feet at 12 Annas per 100 sq. feet, 	660 0 0	
„ Partition Dams and their removal afterwards, including expenses of emptying water by pumps or otherwise, 	500 0 0	
„ Add Supervision, unforeseen Contingencies, &c. 10 per cent on the amount, 	342 0 0	
Carried over, 	Sicca Rs.	3,763 8 0

Brought forward, Sicca Rs. 3,763 8 0

*Expense necessary to new slope the Banks of the Entally
Nullah, if thought necessary.*

To Scarping 3,500 feet of the Banks of the Entally Nullah			
West of the Bridge, estimated 250 Chowkas, at 2/4	562	8	0
„ Sodding 77,000 sq. feet at 12 Annas per 100 feet, ..	577	8	0
			<hr/> 1,140 0 0
Total Sicca Rupees	..	..	<hr/>4,903 8 0

CANAL SUPERINTENDENT'S OFFICE,
November 20, 1826.

(Signed)

THOS. PRINSEP, *Lieutenant,
Engineers.*

To CAPTAIN J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

(A true Copy,)

J. N. JACKSON,
Secretary, Canal Committee.

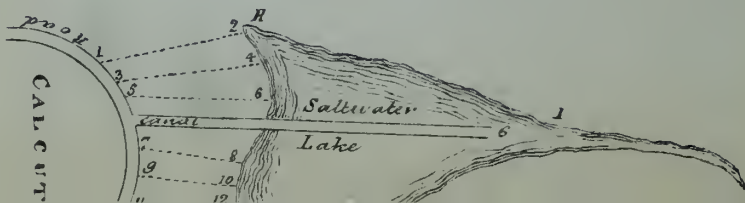
No. 60.

MY DEAR PRINSEP,

I have read over these letters, and think the first object should be to deepen and clear the Entally Canal, and make a Channel through the Lake.

All Canals through which the Tide is allowed to flow, will require constant clearing, from the deposit of the water; and the Entally Canal has no doubt been filled up, owing to the cause stated by Lieutenant Prinsep; but I am of opinion, from the observation made by me, some years since, that there is no necessity for converting the Canal into a Drain; for the end of the Durrumtullah Drain may be turned to the right or left of the Canal, and the water carried into the Lake, in the same way as is now done through many other Drains, which were constructed by Elliot, at my suggestion, along the Circular Road; for the descent towards the Lake in all directions is so great, that it requires little artificial aid to allow the water to flow.

If the Drains of the Town are turned from the Canal, it is probable, that when it is deepened, that it will continue servicable for a much longer time. I differ in opinion as to the effect of Bunding a Channel through the Lake; whether the Entally Canal is to remain the outlet of the Town Drains or otherwise, no injury will follow the Bunding of a Channel through the Lake, if the East and toward the Sunderbunds, is left open; for then the East end of the Lake will be left open for the water to flow into the Sunderbunds, and the Bund would tend to preserve a deep Channel when once made.



If *a. b. c.* were Bunded through the Lake H. I. J. *b.*, the drainage of the Town through the Drains 1—2, 3—4, 5—6, 7—8, 9—10, 11,—12, would find its way into the Lake on the side H, *b*, J, and out at the Channel I, without causing any rise of the water; and even if the Entally Canal were continued to be the Drain, it would make no great difference, if the Bund which is made from *a, b*, were to be continued from *b*, to *c*; but the filth of the Town would always have a tendency to fill the Canal to the level of the Drain at *a*, on the Circular Road, and it always struck me that the end of the Drain at *a*, should be carried into a vertical Masonry Tunnel, with an outlet at the bottom, below the Level of the Canal, if the Drain were to continue to flow through it.

I do not think that increasing the Breadth of the Entally Canal, or adding to the Slope, will be of any great benefit in preserving the depth of the water; for so long as it is made the Drain of the Town, and a great flow of water passes through it, the friction will operate the same as in all Rivers, whether small or great, and there will be a tendency to encroach alternately to one side or the other, in proportion to the resistance of the Bed of its Channel. The great object to be attained in all Canals of the kind is to prevent any flow of water, which can be only effected through the aid of Sluice Gates, which are not expensive when the Level, as in Bengal, is much the same, for few are required.

In the proposed Plans of operation, I observe much time will elapse, before the communication with the Ganges can be completed; and till the end is nearly attained, I see no use in purchasing the ground between Manicktollah Road and the Canal, estimated to cost 2,89,920 Rupees, the price considering the site, appears to me to be very high, for at present it can be only valuable as Paddy-ground, and any delay in obtaining possession is not likely to add to the cost. It can make no difference, whether the Canal is carried 300 or 400 yards nearer the Town, or otherwise to the Hooghly at Chitpore, and if the proprietors of the ground refuse to sell where the Canal is marked, it will be easy to go by a route a few yards more to the East, where it may be obtained on more reasonable terms, and nothing will be lost by delay, and much gained; for we can ill afford to expend so much.

It has been stated, that no return will be yielded till the Canal is finished. I am of a different opinion, and would recommend that Cuts of communication with the *ends closed*, may be constructed from the East of the Entally Canal, in the proposed direction to Hussenabad, and also from Ballegunge, for the conveyance of Goods, and that Tolls be collected from Boats passing on them. If 3 feet water can be retained, they will answer every useful purpose, and afford the Public a cheap and easy communication. The labour of loading and unloading light Boats is trifling, and goods are now conveyed along the Diamond Harbour Road in the Rains, for miles, to within a few miles of Calcutta.

If such Cuts are made, commencing from the East end of Entally, every mile of communication ought to be made to pay, and the progress of the Canal will be going forward, till the whole is nearly ready, without any part of it filling up by the deposit of the Tide Water, and the most expensive part will be left to the last, and till we are enabled to reduce our expenditure to the scale of our income, and can better afford the outlay, than at present.

Yours truly,

H. WOOD.

31st December, 1826.

P. S. I have said nothing about the payment. The best mode would be a Treasury Note bearing five per cent. interest, payable at the expiration of two years, the interest to be payable half yearly. If the five per cent. Loan Note should not be acceptable, but as above stated, it will be better to postpone the purchase.

No. 63.

No. 222.

To J. N. JACKSON, ESQ.

Secretary to the Canal Committee.

SIR,

I am directed to acknowledge the receipt of your letter and enclosure of the 10th instant, and to transmit for the information of the Canal Committee, the accompanying Memorandum prepared from the Records of this Office, from which it appears, that the aggregate quantity of Lands purchased at different times for the formation of the New Canal and Roadways, consists of Beegahs 149 : 2 : 14, and that the breadth of the space intended to be assigned was 150 feet ; viz. 90 feet for the Canal, and 30 feet each side for the Roadways ; but that in a particular spot on one Bank, 60 feet had been purchased instead of 30 on each, wherefore it became necessary to effect the purchase of the 6 Cottahs that is mentioned in the concluding part of the accompanying Memorandum, in order that the original design of Mr. J. Shakespear, of leaving a space of 30 feet on each side of the Canal, might be uniformly observed.

I have &c.

BOARD OF REVENUE,

LOWER PROVINCES,

*The 19th January, 1827.**(Signed)*

G. A. BUSHBY,

Acting Secretary.

No. 63. a.

MEMORANDUM.

The Committee for improving the Town of Calcutta, in an address under date the 27th October 1807, having submitted to the Governor General in Council, the necessity of re-opening the Canal from the Marhatta Ditch to the Salt Water Lake, recommended that a Revenue Officer might be deputed for the purpose of ascertaining, whether the ground which occupied the site of the Canal was public or private property, also to purchase such additional ground as might be requisite for forming a New Canal, from the Point mentioned to the Salt Water Lake, of 30 feet in breadth.

Mr. J. Shakespear having been deputed on the above, made a report on the subject, on the 22d January 1808, and from the abstract which accompanied it, of the expense that would attend the purchase of Lands required for opening the Canal, it appeared, that the Land ascertained to be the site of the old Water-course, and taken as public property to which no claims were preferred by individuals, consisted of Beegahs 6 : 9 : $12\frac{1}{2}$, and that it was necessary to purchase additional Lands to the extent of Beegahs 22 : 15 : $6\frac{1}{2}$, making altogether Beegahs 29 : 5 : 3.

Mr. Shakespear, however, took the opportunity of submitting his sentiments on the benefits to be expected by extending the Water-course into a navigable Canal, reckoning that 90 feet would be required for its breadth, and 30 feet on each side to deposit the excavations on ; in all 150 feet.

Mr. Shakespear's suggestion for making a Navigable Canal, instead of a small Water-course for the mere purpose of Draining the Town, having been brought to the notice of Government by the Revenue Board, that gentleman was deputed, agreeably to the orders of Government of the 4th March 1808, to adjust the price of the Ground for the proposed Canal.

From the abstract of the detailed Estimate of the expense for the purchase of Lands required for the formation of this Canal, which was submitted by Mr. Shakespear, and forwarded to Government on the 1st of July 1808, it appears that the Land ascertained to be the site of the old Water-course, and taken as public property, consisted of Beegahs 13 : 12 : 2, and that it was requisite to purchase from individuals Beegahs 125 : 4 : 12, making in aggregate, a quantity of Beegahs 138 : 16 : 14.

In consequence of a letter from the Board of Revenue, requiring further explanation of the principle on which Mr. J. Shakespear had adjusted the compensation to be paid to the owners, whose Lands were to be appropriated to the purposes of the New Canal, it appeared, that in his former Estimate, there was a deficiency of ten Beegahs, which he had since discovered, and this he explained in a Letter dated 29th July 1808 ; consequently it would be requisite to purchase from individuals, Beegahs 135 : 4 : 12, making, with the site of the old Water-course, viz. 13 : 12 : 2, Beegahs 148 : 16 : 14 Chittaks.

It was afterwards brought to the notice of Government, that instead of 30 feet on each side of the Canal, that 60 feet had been procured on one Bank, and in consequence the track-pathway was intersected on the one Bank by private property, consisting of 6 Cottahs belonging to Beebee Jaun, and her two immediate neighbours, Govindram Bagdee and Gour Hurree, and that the workmen had thrown a considerable quantity of earth on these premises.

The necessity of effecting this further purchase was represented to Government by the Board on the 10th April 1810, and Government were pleased to authorize the conclusion of the purchase. On the 21st of the same month, Mr. Assistant Collector Revelly, to whom had been entrusted the duty of adjusting a compensation for Ground that was taken up by Government to construct four Roads about this period in the vicinity of the New Canal, was directed to effect the purchase of the above 6 Cottahs belonging to Beebee Jaun, &c.

It accordingly, from the correspondence which has been referred to on the Records of this Office, appears, that the first purchase after it was determined

to construct a New Canal, consisted of Beegahs,	135	4	12
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That the one just mentioned consisted of Cottahs,	0	6	0
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And that the whole Ground after the completion of these purchases, in the possession of Government, including the site of the old Water-course. ..	13	12	2
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consisted of,	Beegahs,	149	2	14
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(Signed) G. A. BUSHBY,
Acting Secretary.

No. 72. b.

No. 2.

Account of the quantity of Ground required to be purchased to complete the breadth of the Road on the South Bank of the Canal to 24 feet.

From A. to B.	Length.	Breadth.	Sqr. ft.			
Property of Saik Abdulla, ...	50	× 10	500			
Ditto Henry, ...	275	× 12	3,300			
From C. to D. New Sloping,				Bgs.	Cots.	Chts.
			3800	0	5	4½
Moonshee Ameeruddee, ...	320	× 7	2240			
Mr. Blechynden, ...	350	× 3	1050			
			3290	0	4	9
Total, ...				0	9	13½

(Signed) THOS. PRINSEP, *Lieut. Engineers,*
Superintendent of Canals.

CALCUTTA,
 CANALS' SUPERINTENDENT'S OFFICE,
 19th March, 1827.

No. 77.

No. 52.

To MAJOR J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

Before commencing operation for Dredging and deepening the Salt Water Lake Canal, I deem it necessary to call the attention of the Canal Committee to several circumstances, and some abuses now existing in the Navigation of that passage, which appear greatly to need the interference of the Police or executive power, as guardians of the thoroughfare, without which all endeavours to perfect this communication with the City will be nugatory.

2. I cannot find on inquiry that any Regulation has been even promulgated for the preservation of the navigation in this Channel from obstructions arising from wrecks, the fixing of fishing stakes, or other causes within the reach of remedy, and certainly none appear to be enforced, although the Navigation has suffered, and daily suffers from such causes.

3. The utmost vigilance of the Police appears to be insufficient to keep the Channel clear of Wrecks and sunken Boats, with which the passage is now so obstructed from $\frac{1}{4}$ of a mile within the Balyaghaut Canal to $\frac{3}{4}$ of a mile East of its disembogueement into the Lake, that a boat of any ordinary size can with great difficulty and peril make its passage. And at present, it would be impossible for the Dredging Boats to be brought to the shoal water at the mouth of the Balyaghaut Canal, where excavation is first needed.

4. A practice exists among the proprietors of the large Wood Boats of 2 to 4000 mds. burthen, drawing when laden 7 to $9\frac{1}{2}$ feet water, which otherwise deliver their freight to the Lighters or (Obra Boats of 150 mds.) at the distance of about 2 miles East from Balyaghaut, of bringing all their condemned Boats into the shallow water at the mouth of the Canal, where they frequently sink in the Channel, and are either totally abandoned as wrecks by the owners, or left till some purchaser is found to break up as much as he finds it worth his while to carry away. At the present moment in one space in the Canal, (having generally 5 to 7 feet water,) of 200 feet in length, there are no less than 7 of these boats sunk; none of which will be removed for some considerable time without the interference of the Police, and none will ever be entirely removed.

5. Another practice exists among the owners of the small Craft that act as Lighters, few of which are very water-tight, (having generally been constructed from the breakings up from the above-mentioned wrecks,) of allowing their Craft, when unemployed, to sink indiscriminately in any part of the Canal, choosing in preference the shallowest parts. Their being under water, preserves the seams from opening, and it is a matter of the greatest ease to refloat them when required.

6. During the last six months, the number of Boats wrecked between Baminghatta and the Eastern Canal has been unusually great. The loss has not been entirely limited to the firewood Craft, which as being generally of least substantial construction, suffer most. I have observed during this period, that by far the greatest obstruction to the Channel has been occasioned by the abuse above-mentioned;* for when a Lime or Grain Boat is wrecked, the crew and owners take immediate measures to save the Cargo, and raise the wreck. The same happens with all the better description of Craft, and even with the new Wood Boats. It is not, however, the case with the generality of Wood Boats sunken, and seldom with any large Wood Boats of 2 to 4,000 mds. which wreck in the shallow water at the West end of the Lake Channel; for in the first place, by far the greater number of Craft employed in the firewood trade are of very inferior description, old and decayed; in the second place, few of the latter description (2 to 4,000 mds.) are brought so near the City, except when condemned or wanting repair, and if in their passage to the shoal water at the end of the Balyaghaut Pucka Road, (where boats are usually hauled up for such purpose,) they sink in the Channel, they are abandoned. A purchaser of the wrecks seldom removes more than he can reach at low water-nucleus, is thus left for the aggregation of mud, and sometimes of other wrecks, upon the many projecting pieces left in the bed of the Channel.

* Para. 4.

7. The object of the present observations is to induce the Committee to call the attention of the Magistrate to the subject, in order that [by] his interference, as many wrecks as the owners may be induced to remove, may be so without delay, and to request their sanction to my incurring any expense that may be necessary in removing the remainder, previous to the arrival on the spot of the Dredging Machinery.

8. At the same time, as I cannot but be sensible that a great portion of the obstruction arises from abuse rather than accident, I cannot refrain from suggesting the propriety of some regulations for the future preservation of the Navigation.

9. A mulct and forfeiture of the wreck appears to be justly merited by any owner who makes no exertion within even 48 hours to remove such wreck out of the passage, where it endangers other property, and obstructs the Navigation. The practice of allowing boats

to remain sunk for their preservation in the Channel, should be wholly prohibited, and visited with a heavy fine, or immediate forfeiture of the boat. The large Wood Boats might be limited according to their draft of water to certain distances.

10. It is far from my intention, however, to do more than suggest the objects which require remedy, and to point out the necessity of some rules for the maintenance of the Navigation. Without some penalty, it appears impossible to induce the Natives to consider the hindrance offered to the public by their boats remaining sunk as at present for months, and I should conceive that ultimately the produce of any fines that may be levied, and the sale of forfeited wrecks, would suffice to pay the expenses of their removal in such shallow water, and of any Establishment necessary to give the necessary notice when the assistance of the executive is required to raise a wreck.

11. The Committee who have ever been alive to the improvement of the Inland Navigation in the vicinity of Calcutta, will be more competent to frame any rules necessary for its good management; and I have to request their indulgence, if I have overstepped the line of my duty in bringing such subjects to their attention. In the meantime, as my Dredging operations will soon commence in the Lake Channel, I have to request their early consideration of the request conveyed in the above Paragraph No. 7.

I have, &c.

CALCUTTA,
CANAL SUPERINTENDENT'S OFFICE,
19th June, 1827.

(Signed)

THOS. PRINSEP, *Lieut. Engineers,*
Superintendent of Canals.

No. 78.

(No. 120.)

To J. MASTER, ESQ.

Magistrate of the 24-Pergunnahs.

SIR,

I have the honor, by desire of the Canal Committee, to transmit to you, the annexed Copy of a Letter from Lieutenant T. Prinsep, Superintendent of Canals, dated the 9th instant, bringing to the notice of the Committee the existence of certain abuses in the Channel of the Salt Water Lake, and at the entrance of the Baliaghaut Canal, tending to impede the Navigation of that passage, and suggesting such remedies as appear to him calculated to remove the evil complained of, and prevent its future occurrence.

The Committee being aware how essential it is to the interests of the City that this Channel of Communication should at all seasons of the year be kept free and clear from obstructions of any kind, that might operate to retard the Navigation, or cramp the extensive Trade that passes through it, have directed me to request, that you will oblige them by adopting such necessary measures for clearing the Channel of the Sunken Boats that at present prove so great a source of hindrance to the Trade, and for the future preservation of the Channel from similar obstructions to those now complained of, as may appear to you best suited to meet that object.

I have, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
18th June, 1827.

(Signed,) J. N. JACKSON,
Secretary, Canal Committee.

No. 79.

(Copy.)

To MAJOR J. N. JACKSON,

Secretary to the Canal Committee.

SIR,

On the receipt of your Letter of the 8th June, which was accompanied by a communication from Lieut. Prinsep, Superintendent of Canals, I adopted immediate measures for clearing the Salt Water Lake Canal, and for removing the obstructions which Lieut. Prinsep had brought to the notice of the Committee.

It was at that time remarked by the Members, that the removal of wrecks could only be accomplished by a suitable Anchor Boat, to which it would be necessary to attach a sufficient Establishment, and as the Committee trusted to me for the preservation of a free passage through the Channel, I visited the Dock Yards for the purpose of procuring a Boat calculated for the purpose. The cost however of an Anchor Boat appeared so exorbitant that I refrained from entering into any agreement with the builders.

For a trifling sum I have been able to purchase and fit up a Country Boat, which proves extremely serviceable, and promises to supersede the necessity of engaging a more expensive Vessel. I have the honor to forward a bill, which includes the original cost of the boat, with a statement of the charges incurred in rendering her useful, which I request you will be kind enough to submit for the sanction of the Committee, and I would recommend that the following Establishment be entertained and attached to the boat from the 1st Proximo:—

1 Serang,	...	...	...	...	Sa. Rs.	7
1 Tindal,	...	...	...	...	...	5
4 Dandies, @ 4 / each	16
Sundries for the use of the Boat,	2

Total	Sa. Rs.	30 per Mensem.
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I have, &c.

(Signed) J. MASTER,
Magistrate.

FOUZDARY AUDALUT,
SUBURES OF CALCUTTA,
25th August, 1827.

(A True Copy,)

J. N. JACKSON,

Secretary, Canal Committee.

No. 85.

(No. 169.)

To LIEUT. T. PRINSEP,

Superintendent of Canals.

SIR,

With reference to Paragraph 7th of your Letter of the 28th ultimo, on the subject of the obstructions that have accumulated in Tolly's Nullah, I am desired by the Canal Committee to request, that you will oblige them by furnishing, at your earliest convenience, a full and particular Report on the present state of that passage, mentioning at the same time the measures that you would deem necessary for deepening and improving the Nullah, so that it might become fit for the purposes of Trade and Navigation.

The Committee are also desirous of ascertaining your sentiments, as to whether Dredging Apparatus might not be advantageously employed on this service, particularly at those places where the obstructions are caused by the formation of Sand Banks.

I have, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
14th September, 1827.

(Signed) J. N. JACKSON,
Secretary, Canal Committee.

No. 87.

(Copy.)

No. 73.

MAJOR JACKSON,

Secretary, Canal Committee.

SIR,

The instructions conveyed in your Letter No. 169, appear to have reference to some expressions in my Report of 28th August last. The particular remark which has called the attention of the Committee to the state of the Navigation of Tolly's Nullah, I conclude to have been the following: "That, as, (when the removal of the old confined Bridge "has had full effect,) the rise and fall of the Tide will increase, and the passage become more "affected by the Tides in the River, it may be expected to become even more limited in its "facilities of Navigation." I will now proceed to detail my views upon the subject, which suggested the remark in question, and at the same time many subsequent observations which appear to confirm my first impressions.

The subject is involved in some considerable intricacy, and can only be treated upon the pure principles of the science of Hydraulics, I hope therefore the indulgence of the Committee, if I limit myself to the general outlines of the case, and refrain from introducing into my Report the more minute calculations, which perhaps would not excite the same interest in those whose avocations do not allow their considering such subjects with equal attention, and which had better remain confined to my own notes.

The Committee are, I doubt not, already aware, that in any running stream, if by

accident or design the Channel be contracted to less than its natural section, the effect of such contraction is to create an artificial elevation of the surface of the water at that place, which elevation extends in a curve to a certain distance up the stream. This elevation is denominated by the writers on the subject, *an afflux*, and the distance to which it extends, *its amplitude*. Dubuat has furnished a formula, from theory and experiment combined, by which this *afflux* may at any time be calculated. Its variation is regulated by the velocity of the stream and nature of the contraction.*

The several affluxes, created by the contractions of the Channel and height of the floors at the several Bridges of Allypoor, Kidderpoor, and Gurryahaut, may be assigned as the chief causes, why the annual and daily variations of the Tide differ so considerably at these several places from the correspondent variations of the Parent Tides in the River Hooghly and Tarda Salt Nullah. It cannot therefore be very difficult to comprehend, how the removal of such causes will have a prejudicial effect in decreasing this difference; inasmuch as it may lower the present levels of the Ebb Tides of the dry months, throughout the passage.

I annex in the margin what I have deduced as the relative levels and variations of Tide in the different parts of the Nullah, from observation and inquiry.

The levels have not been

Hooglee River.		Kidderpoor Bridge.	Allypoor.	Tolly Gunge.	Gurrya.
Ft. In.	Floor or bed under Bridge	+ 0 6 -	+ 1 7 +	+ 2 1 -	+ 1 1
20 6	Annual Variation, ...	18 0 -	15 8 -	11 10 -	8 5
12 5	Daily Var. Sept. Eqx. ...	11 5 -	10 2 -	6 4 -	3 6
20 6	Highest Water Mark, ...	+19 6 -	18 3 -	+15 3 -	+11 11
0 0	Lowest ditto, ...	+ 1 6 -	2 7 -	+ 3 5 -	+ 3 6

N. B.— At the mouth of the Kamapookrya Nullah, the floor of the Nullah is as high as + 3 — Here the Tides meet in the dry season, and from hence in the rains the stream runs continually eastward, towards the Gurrya side.

compared by actual admeasurement instrumentally, but the principle upon which they have been ascertained, leave very little doubt of their accuracy.

The quantity of water left in the Nullah in its driest state, is found from this Table by comparing the lowest water mark of a place with its floor. Thus at the mouth of the Kumapookrya Nullah, where the floor is at $\times 3$, and the lowest water some 6 inches above that of Gurrya and Tolly Gunge, there remains not more than 1 foot at the lowest Tide, and for the length of 3 miles between Tolly Gunge and Gurrya, not more than an average of 2 feet.

Of the two Tides which flow into this Nullah, that from the Salt River of Tarda is later than that from the River. This cause, combined with the very great afflux at Allypoor and Kidderpoor, is the reason why the Ebb during the dry season remains up at the elevation which has been observed.† Indeed the floor of the Allypoor Bridge, which is 1 foot and 7 inches above lowest water-mark of the River, will always prevent its falling much lower than at present. Remove this cause, and give every facility to the free ingress and egress of Tide from the Hooglee, and I have little doubt that the surface of the water at Tollygunge during the Ebb may, by such increase in the discharge be lowered more than a foot; for this afflux must of necessity have a greater influence in the expenditure of the Ebb than in the influx of the flood: inasmuch, as the ratio of contraction R, (which is a multiplier in the formula,) is in this case the greatest. Indeed the floor of the Allypoor Bridge would act as a retaining dam, if the water within it fell to its own level, which is 1 foot and 7 inches above the lowest Ebb in the Hooglee.

With these remarks before them, the Committee will at once comprehend the difficulty of ever making the passage in question fit for all navigable purposes, at every state of the

*De Haviland's Translation, Part 1 Section 3. Ch. 3.

The equation is $\left(\frac{V^2}{2G} \times P.\right) + (K^2 J)$ where

V = Velocity.

G = Diminished gravity.

P. = Slope naturally.

K. = Ratio of contraction.

† Vide the above Table, the Ebb remains up between 2 and 4 feet above the Ebb in the rains.

Tide. To secure a sufficiency of water when the present contractions are removed, the bed of the Nullah will equally require deepening in the Kidderpoor and Allypoor division, as at Tollygunge and Gurrya. And if such is ever carried into effect, the superior elevation of the Tide during the Equinoxes of September, which is now depressed by the affluxes at Allypoor and Kidderpoor, (each of which may be taken at 15* inches or more, when the Tide in the River is at the highest,) appear to threaten a rapidity of current and corresponding elevation in the Jheels, which are hence supplied with water, that may occasion injury to private property.

Upon mature deliberation, I am therefore inclined to abstain from recommending the use of Dredging Machinery in this Nullah, as much too expensive, and perfectly ineffective against the evils with which we have to contend; and which exist in the particular nature of the passage. It is also very doubtful, whether, if the bed were excavated by manual labor to the depth required between Tollygunge and Gurrya, it would not fill to its former height in the course of a single season of irruption from the Freshes of the River. The Nullah at present has a less section beyond its junction with the Kamapookrya Nullah, which contracted form extends for many miles beyond Gurrya. This alone would create a check sufficient to cause the turbid waters from the Hooglee to deposit to the former bed, and such cause will remain, until the remote period when the Gurrya Nullah has excavated itself to a sufficient relative section.

I have therefore looked to other means than excavation, to create an additional depth of water in this passage during the dry months at Ebb Tide, and hope to be able to offer a method that shall secure one or two feet more than is at present found at Ebb Tide, and increase rather than diminish the depth of water at Flood Tide. I have chosen in preference to the very expensive plan by Tide-gates, the more simple and economical one derived from the principles of the afflux which I have just enumerated, and the method of application of this principle, which I would suggest, is to create an afflux or several affluxes, against the Ebbing Tide, at the same time that the Channel should remain perfectly free to the flowing Tide.

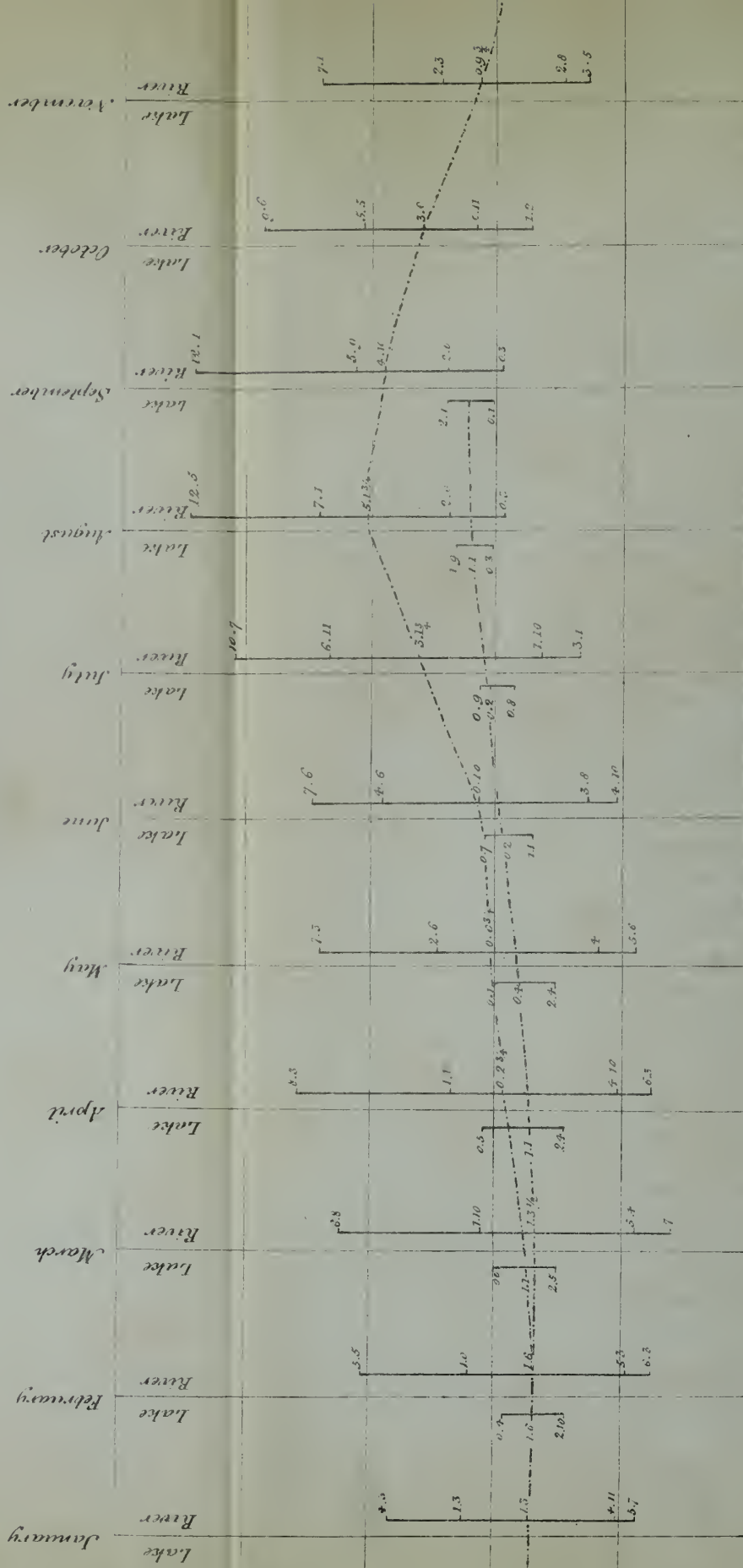
I do not offer the present as a measure calculated entirely to obviate the difficulties of this passage. It is my opinion, which I have already given elsewhere, that a small Nullah of this kind, into which the turbid waters from the Hooglee are allowed free ingress, can never be expected to remain perfectly navigable throughout the year, at every state of Tide, on account of the very great variation of Tide in the River, and the diminished velocity of the water in such a Channel, which must invite a deposit of all the grosser particles of matter which are held in suspension by the water which is admitted from the River, if no more.

I have here earnestly to recommend the Committee to instruct the persons, I believe Convicts, who are engaged in clearing away the foundation of the Kidderpoor Bridge, and the Officer that may be engaged hereafter in dismantling the Allypoor Bridge, to be cautious how they endeavor to lower the floor of the Channel under these places, and to urge upon their attention this principle; viz. to enlarge the Channel as much as possible in all contracted places above the mean water mark, but by no means to enlarge it below this mark at present. All the enquiries I have made, seem to agree in the fact, that the Ebb, during the last dry season, fell to a lower level than it had been known to fall before, and which I may very fairly place to the account of what had been done at Gurrya, and at Tollygunge and Kidderpoor.

I have drawn up separately the Memoranda in explanation of the method I have thought best adapted to improve the passage in question, and if the Committee upon consideration think it advisable, will proceed to construct one or two of the shutter Dams, by way of ex-

* It would be 15 inches when the contraction or $K=2\frac{1}{2}$, and the velocity $V=52$ inches per M., or 3 miles per hour





Note. The dotted line denote the average mean level of the Tide for each Month.
 On the River side gage — The Springs and Neaps are set down —
 On the Lake side gage — The extreme High and Low water mark only.

periment, and will report upon the result. The expense will be trifling, 400 Rupees at an average at each place, where it is required to create an afflux. The Navigation will be no wise impeded by them, and in case the method is not attended with the success anticipated, their removal will be easy and immediate. The situations where I consider it to be first necessary, are Gurryahat and Tollygunge, after which I would propose Allypoor.

I have, &c.

CALCUTTA,
CANAL SUPERINTENDENT'S OFFICE,
8th October, 1827.

(Signed) THOS. PRINSEP, *Captain, Engineers,*
Superintendent of Canals.

(True Copy.)

Secretary, Canal Committee.

No. 87 a.

(Copy.)

Construction.

A shutter 10 or 15 feet long, by 6 to 9 feet wide, A. B. swinging upon an axis terminated by two iron gudgeons, *b. b.* strongly affixed to the frame of the shutter at the depth of $\frac{1}{3}d$ or $\frac{1}{4}th$ from the tops. These gudgeons bearing upon the top of one pile *a. a.* which rests against, and is fixed to a longer pile *c. c.* by a mortice and strap of iron, also embracing the gudgeon. A long arm to be fixed to the centre of the shutter, upon which may be hung a counterpoise. A girder rail, *d. d.* to unite the top of the long piles and steady the whole frame by uniting it to the bank of the Nullah.

When the Tide is flowing, the shutter opens by the pressure of water, as shewn by the dotted lines in Fig. 3, and if the Tide has not power to overcome the poise of the shutter, an addition to the counterpoising weight on the arm or level will open it.

The drawing represents the shutters closed against the Ebb, and as the pressure of water is not powerful, the piled framing is quite sufficient to sustain it.

The figures 1 and 2, is an application of this contrivance to the section at the new Gurryahat Bridge. The construction will differ at Allypoor and Kidderpoor, where the variation of Tide is greater, but not very sensibly at Tollygunge.

(Signed) THOS. PRINSEP.

(True Copy.)

J. N. JACKSON,

Secretary, Canal Committee.

No. 89.

(Copy.)

No. 78.

To MAJOR J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

As the late orders of Government will put it in the power of the Committee, shortly to enable me to prepare the ground for the Ooltadanga or Circular Canal, I have thought it opportune to submit the accompanying Memoir and Plate regarding its scheme of construction, in order that the subject may have full time for consideration, before the actual commencement of excavation.

The introduction of Gates into the system of Navigation of this Country, which has hitherto been conducted upon such crude and unscientific principles, may at first view appear as unnecessary an innovation into the old established routine, as at one time the introduction of steam was considered, on account of the low rate of labour: and I can scarce anticipate the immediate and unqualified reception of the accompanying scheme without some preliminary discussion.

The chief advancement upon former principles of Navigation in the Delta, contained in the scheme of my predecessor, is comprised in his exclusion of all turbid water from his Canals, which might be introduced from the Freshes of the different subsidiary mouths of the Ganges. By the introduction of Tide Gates, I have gone one step further to secure them from the great variations of Tide, which are found in those streams, and when I recur to the observations I had the honor lately to submit, concerning Tolly's Nulla, I am led to conclude, that a system of Tide Gates will be found in the end, both the least expensive and only efficient method of preserving the constant Navigation of any small Canal or Stream, which desembogues into a large Tide River, exhibiting so very great daily as well as annual variation of surface, as the Hooglee.

I beg therefore to express my perfect acquiescence, in any measures that the Committee may think it advisable to take, in order to procure the opinions of other Officers more conversant in the subject than myself, and have with all due diffidence in my own judgment, to request, that I may be allowed to reconsider any part of the subject, which on discussion may appear not sufficiently demonstrated, before any alteration is decided upon finally, in consequence of opinions thus received.

I have, &c.

(Signed) THOS. PRINSEP, *Captain, Engineers,*
Superintendent of Canals.

CALCUTTA,
CANAL SUPERINTENDENT'S OFFICE,
31st October, 1827.

(True Copy,)
J. N. JACKSON,
Secretary, Canal Committee.

No. 89. a.

(Copies.)

Memoir upon a Design for Improving the Construction and Management of the Circular Canal of Communication, between the River Hooglee and Salt Water Lake, as sanctioned upon the proposition of the late Major J. A. SCHALCH in his printed Memoir, submitted to the Canal Committee by Lieutenant PRINSEP, Engineers.—October 1827.

1. In the Second Appendix to Major Schalch's printed Memoir, containing his proposal of a design for improving the Navigation of the Delta of the Ganges, that enlightened Officer's views and calculations are fully detailed regarding the intended disposition of the Circular Canal of Communication between the River Hooglee and Salt Water Lake, a part of the extensive undertaking, comprised in that Memoir, upon the feasibility of which most doubt was entertained; and from which if successful, the greatest profit and advantage were anticipated.

2. The calculations and remarks in that Appendix, were called for, to allay certain apprehensions entertained by many Members of the Special Committee, before whom the subject was submitted, of great inconvenience, if not imminent danger to the City of Calcutta and environs, from allowing the waters of the Hooghlee unrestrained ingress into the Lake, the extreme difference in their surfaces being known to reach 12 feet in the rainy season.

3. The principles upon which those remarks have been founded, as well as the general tenor of the conclusions drawn from the different calculations are correct, with some few exceptions. The deviations from the original scheme, therein contained, which I am now about to suggest, will I trust, be considered as proceeding from a more mature consideration of the subject, and I shall be fully content, if they are examined strictly upon the identical principles originated by the author of the Memoir.

4. I will in the first place describe in outline, the Plan proposed in the Memoir, and sanctioned by the Supreme Government for the construction of the Circular Canal, and the principles upon which the scheme was founded. After which, I will proceed to detail my own views upon the different points, and my reasons for substituting the annexed design, in preference to the simple method proposed by my predecessor.

Major SCHALCH'S Design.

5. A Canal to be excavated from Chitpore to the present Eastern Canal, at a point East of the Koolya Bridge; the total length, 19,500 running feet, equal to $3\frac{1}{10}$ miles. The breadth at low water to be 90 feet, and depth 7 feet; average depth of excavation 23 feet, mean breadth 108 feet.

6. The part of the Eastern Canal from the junction to the Lake to be deepened, level with the bottom of the New Canal, and embankments to be formed in the Lake itself, so as to secure a length of Canal from Chitpore to the point on the Lake, where the water will be allowed to spread, of 7 to 8 miles.

7. The bottom of the Canal being fixed at 7 feet below low-water mark in the Hooghlee, would thus be 14 feet below Zero, or the average surface of the Lake.*

8. It was observed, that at the highest state of the River Tide in September, the slope of the water in the Canal would reach 12 feet, to be divided over a length of 7 miles; and in April and May that it would occasionally amount to 8 feet. The velocity expected in the former case was $3\frac{3}{4}$ miles per hour, in the latter case $2\frac{9}{10}$ miles per hour, from which velocity, the writer apprehended little or no danger to the banks of the Canal, as the duration of such velocity could not be very long.

9. The levels at which it might be expected that the water in the Canal would remain at the different points, where the Drains of the City would have their exits, threatened such inconvenience to the Drainage; added to the fear of the choking of the Canal from the Sand and Silt derived from the turbid waters of the Hooghlee, that the projector at once abandoned the idea of allowing the communication to remain open during the entire year. He says, "The stability of my other Canals is built entirely upon their not being exposed to the Freshes of the River."

10. With this view, he therefore proposes an economical and simple method of closing the communication for 3 months of the year, a drawing of which is annexed to the Memoir in Plate II. fig. 2. The method is derived from what Belidor and other authors describe as

* The average surface of the Lake being taken as Zero, or the base of the system of levels, the extreme low-water mark of the River Hooghlee is found $7\frac{1}{2}$ feet below it. The excavation, if carried $6\frac{1}{2}$ feet below this, will be 14 feet below Zero.

being used in the Fortresses of the Rhine and Netherlands, to stop the running water of a River, and create at pleasure an inundation of the Country around its glacis, of any extent or depth.

11. Farther, as it was an acknowledged disadvantage to close all communication with the Canal, which he denominates a Harbour to the City, Major Schalh proposes that this artificial Dam should be placed at the intersection of the Dum-Dum Road; thus leaving the remaining portion of the Canal towards the River, to act as a safe retreat from the dangers of the River.

12. In the above Sketch, is comprised all that has been offered by Major Schalh upon the subject of this Canal; with the exception of a method of guarding against all possibility of failure, in excavating to the required depth, from the occurrence of a Stratum of Ooze and Sand, a Sketch of which is annexed, Plate II. fig. 1.

13. In preparing the accompanying design, my object has been to unite economy with utility; and although I have perhaps, by substituting a system of Gates for the Sleeper Dams, departed from the simplicity of design, so much the aim of the original projector, I should hope that the advantages to be obtained by such application of scientific principles, will not be thought too trivial to be purchased even by a small addition to the Outlay.

When, however, I can demonstrate to the conviction of every unbiassed judgment, that this substitution will, instead of adding to the expense authorised for the work, rather create a saving; besides obviating many difficulties that appear likely to endanger the success of the undertaking as at present constituted, I should humbly conceive that the mere objection of want of simplicity, cannot for a moment deter the Committee from recommending its adoption to the favorable consideration of the Supreme Government.

14. I will proceed to state, the chief difficulties and objections which may be urged against the present design for the Circular Canal.

15. *First.* With regard to the depth to which it will be necessary to carry the excavation, from 25 feet to 19 feet, or average 23, the different wells sunk for the purpose of examining the Substrata, have pointed out the existence of a Stratum of Oozing

	Ooze.	Blue clay.
* Balyaghat Road, depth	18	feet to 21
Raja Ram Lochun's Road, „	22	feet to 27
Manicktolla Road, „	25	not pierced to clay.
Saum Bazar, „	„	No sand.
Chitpoor Cross Road, „	19	feet to 25½
Baug Bazar, „	21	feet to 23

Sand at the various depths of 18, 22, 25, 19,

21.* The elevations of the Road opposite these several points are respectively, about 7, 8, 8, 14, 18 feet above the average surface of the Lake, or Zero. The excavations agreeable to the design, will

therefore be respectively, 21, 22, 22, 28, 32. In all these cases but one, will the Stratum of Oozing Sand be touched, and in the latter two, the excavations will have to be carried much below it.

16. *Secondly.* It has been found impracticable to construct the embankments in the Lake, and Major Schalh himself has already proposed their abandonment in his Report of the operations in 1823-24. The distance over which the fall of water has to be divided, will thus be reduced from 7 to $5\frac{1}{2}$ miles. The correspondent increase of velocity of the April fall of 8 feet, now become 17 inches per mile, will be $3\frac{4}{10}$ miles per hour, instead of $2\frac{9}{10}$, or within $\frac{1}{2}$ mile of what was calculated for the extreme case of 12 feet fall.

17. On this point, of the effects of such current upon the bed and banks, I apprehend, they are much underrated in the Memoir. The experiments of Dubuat upon the subject, would assign a much more considerable power of corrosion to such a current. The remarks and observations of Major Schalh on the Current in Tolly's Nullah, are far from conclusive, and it does not appear that he has at all considered the effects of the obstructions created by Bridges upon the phenomena of the Tides, or the deposit of Silt. In that part of the Nullah, East of Gurriahat, where all obstructions of the kind cease, and where the Canal ap-

appears to be in what is called by Dubuat, *perfect regimen* ;* both the velocity and fall is always less than that stated by Major S. as observed, and no deposit of any consequence appears to take place.

18. The greatest velocity of Current in Tolly's Nullah happens when the water enters from the Hooghlee, so overcharged with sand and clay, that it would be quite incapable of holding in solution or even suspension, any thing beyond what it already carries ; and might indeed be expected rather to deposit what it holds, than to excavate the bed and banks of the Nullah ; as the velocity in the Nullah is less than in the River.

19. It was the intention of the author of the Memoir, to construct the several Bridges, over the New Circular Canal, that little or no obstruction might be offered to the free passage of the Current ; and with this view, no allowance has been made in the calculations, relating to the expected fall and velocity for such impediments.

20. In Tolly's Nullah, before the removal of the old Kidderpore and Tolly Gunge Bridges, the effect of the obstruction may be somewhat conceived in its influence upon the phenomena of fall and velocity, when I mention, that (by actual observation) while in the Hooghlee River, the extreme annual variation of the Tide amounted to $20\frac{1}{2}$ feet, at Gurryahat, a distance of nine miles by water, the extreme annual variation did not exceed 7 feet. An alteration in the Tides of this Nullah since the construction of the Suspension Bridges is already very sensible ; and it is easy to foresee much greater alteration upon the entire removal of the old foundations of the Kidderpore Bridge, and when the Allypore Bridge is likewise removed for a Suspension Bridge of the same kind.

21. I should therefore consider, that it is scarcely safe to weigh the future success of the scheme upon any observations collected from the phenomena of Tides in the Nullah in question, until it has assumed a perfect regimen under the new order of things ; which will obtain when Suspension Bridges are constructed in place of all the old timber ones. And I should incline to the opinion, that the author of the Memoir has far underrated the effects of wear and tear to be anticipated, from the unrestrained passage of Tide-water, which he has proposed. The extreme velocity of Current which could be at any time desired to run through the Canal, either for the purpose of cleaning it from rubbish, or for the facilities of Navigation, cannot be more than two miles per hour. I should estimate it even less, and it is of the highest importance that all water, which is introduced from the River, should be clear from Sand or Silt.

22. The next point upon which I have to offer any remarks, is the variation of the surface of the water in the Canal into which the City Drains will still be conducted. His views upon this subject, chiefly influenced my predecessor in the determination to close the Channel during the months of July, August, and September. It appears to me, however, that the same inconveniences will occur in April, May, June, and October ; for, during these months the Tides rise inconveniently high during the Springs, and heavy rain very frequently falls. If by any chance during the Springs, heavy rain should fall while the Tide was rising in the Canal, (by no means an improbable case,) the running off of the rain water from the Streets of Calcutta, would be delayed full six hours.

Further, the average flood level opposite the main Dhurumtullah Exit-drain, during these months would be more than 2 feet above θ Zero, the extreme flood level being nearly 5 feet at the least. The present Sill of that Drain is 2 feet and 1 inch above Zero, so that on many occasions the Tide Water would flow up the Drains, in times when much rain may be expected to fall.

* *Perfect regimen*, is a term used by Dubuat and his translator De Haviland, denoting that state of a Conduit Pipe or Canal, when the velocity and slope have assumed an uniformity throughout the length, proportional to the Section, and when the Bottom and Banks no longer appear to alter their form from corrosion or deposit.

23. Major Schaleh has, I fear, in proposing to close the communication for any period,				valued the advantages of the passage too lightly, nor
* Year 1822 and 23. Number of Boats.				does the account* obtained from the Collector's
January,	997	Books for 1822-23, at all warrant his supposition of so		
February,	1,205	great difference in the thoroughfare for these months.		
March,	1,018	If, however, it is at all expected, either that the		
April,	884	traffic by the Eastern or Sunderbun route, will in-		
May,	829	crease upon the improvement being completed, or		
June,	1,127	that the superior advantages of the New Canal will		
July,	538	attract the most of the Trade which now passes		
August,	645	through Tolly's Nullah, such stoppage of the Canal,		
September,	813	cannot but be considered as a very great sacrifice.		
October,	849			
November,	879			
December,	841			

24. This point, however, which does not in any way relate to the Engineering part of the undertaking, will be much better understood by the Members of the Committee and Officers of Government, who are concerned in the collection of Revenue, and I therefore refrain from any further remarks upon the subject.

25. The only remaining point upon which I have to object, is the nature of that portion of the Canal which Major Schaleh has left, as a bason of shelter from the dangers of the River. Westward of the Timber Dams across the Saumbazar Road, it is left subject to the gradual flux and reflux of Tide under the worst possible circumstances, when the water which will flow into it, is overcharged with Sand and Silt of the most gross kind. It will not possess in itself any means of scouring the sediment caused by the stagnation of every Tide, while the Dams are closed; nor at the end of the season when the Dams are raised, can any sufficient rush of water be brought to bear upon it, that would excavate all the accumulated sediment of these three months. Indeed it might be apprehended, if a scouring force could be applied, that the rest of the Canal and Lake would suffer in consequence.

26. I have thought it unnecessary to consider what would be the effect upon the level of the Lake, by the free admission of Tide proposed in the Memoir. It is a point very difficult to reduce to any thing beyond speculation. There is, however, quite sufficient reason to suppose, that great alteration would take place in its Tide phenomena, and that such alterations might tend disadvantageously upon the present system of Draining the Town.

27. Having now enumerated the principal difficulties and objections which occur to me, as likely to attend the construction of the Circular Canal, sanctioned upon the proposition contained in the printed Memoir, I will proceed to detail the principles upon which I have framed the annexed design, in order that the Committee may judge upon the comparative advantages of the two methods, and after mature consideration, determine which may be most worthy of adoption.

28. The basis of any consideration, upon the junction of two Tide Waters must necessarily rest upon the accuracy of Tide Registers, kept even daily. I have myself kept a daily Register of the Tides in the Eastern Canal, by a gauge fixed on the Masonry of Koolya Bridge. For those of the River I am indebted to the very valuable and elaborate Registers of Mr. James Kyd, for whose liberality and readiness in allowing me every access, I cannot refrain from expressing my grateful acknowledgment.

29. I have annexed an abstract from the two Registers, upon *which the greatest* reliance may be placed.

30. The advantages which I propose to secure by the substitution of Tide-gates, instead of the very unscientific and imperfect method of Damming up the passage, as suggested in the Memoir, will I trust obviate most, if not all, of the objections which I have enumerated above.

31. The saving of 4 to 6 feet, in the depth of excavation, will, in most cases, save the necessity of piercing the stratum of Oozing Sand; besides the great saving in the expense of digging.

32. The Canal and Lake is secured from any possibility of danger or alteration, either from the rapidity of current, or influx of Sand introduced through the Canal.

33. The facility of Draining the Town, instead of being endangered, will be increased. As the admission of River Water, and its velocity and fall, will be entirely under controul, and may be regulated by the manœuvring of the Water Gates; not only will the chance of the Canal being choaked with Silt from the River be obviated by closing the Gates whenever the River Water is turbid, but the means will be afforded of introducing a current of clear water, nearly fresh, which will add to the salubrity of the vicinity of the Lake, and clear any Silt or Rubbish which may accumulate in the Canal, thus obviating the causes of failure of the present Eastern Canal from stagnation.

34. The adoption of this method of artificial Navigation will secure a daily intercourse with the River throughout the year. The water, from not being allowed to ebb back into the River, will remain sweet* even to the Lake. A secure floating Dock, with 8 feet water at the lowest, will be gained at a trifling expense, in which even Sloops, (rigged,) may take shelter, if one of the Outer Bridges be made to lift or to turn, as in the London Docks. And the general management and Navigation of the Canal, from the gentleness of the current, will be in every respect, superior to what it would be, were the Canal subject to the great variation of Tide which exists in the River.

35. In conducting all works of such nicety and extent, many unforeseen circumstances occur, to alter the details of construction first proposed, and many improvements suggest themselves in its progress. The Plan I have submitted to the Committee, will I trust, be considered as sufficiently explanatory of the general outlines of the construction best adapted to the work, and of the disposition and management of the Gates.

36. I have annexed comparative Estimates of the excavation of the Canal upon the two different designs, likewise particular Estimates of the expenses of the system of Gates, with their Masonry and Bridges, with a general Estimate of the expenses of the Circular Canal according to the new design, compared with what has already been sanctioned for this part of the great undertaking which has been entrusted to my charge, and I have now only to await the period, when the Committee have themselves taken the subject into their serious consideration, when if any part of the subject appears to require any more elaborate explanation, I have only to state my readiness to enter into calculations and discussions, which I have thought beyond the province of a mere Memoir, like the above.

(Signed) THOS. PRINSEP, *Captain,*
Engineers.

Scheme.

First. The general direction of the Canal, between the River at Chitpoor and Eastern Canal, to remain the same as already laid down in the large Survey Plates, prepared by Overseer Turner, under the direction of the Canal Committee; the depth of the Canal to be 8 feet below the average surface of the Lake, instead of 14 feet, the breadth at that surface to be 90 feet, as in the Section fig. 6.

* It is not meant here that the water will be sufficiently sweet to drink, but comparatively sweet. The water in the Hooghlee, from whence it will be derived, is never so brackish that it cannot be used at Low-water, and is palatable at High-water till March, except in the Spring Tides.

Secondly. Four of the Suspension Bridges proposed in the Original Scheme to remain as projected. The fifth to be converted into a system of Tide Gates, as described in the accompanying Plate, and to be placed at the intersection of the present Chitpoor Road, the direction of which, in the immediate neighbourhood of the Gates, to be altered to form a convenient and handsome approach.

Thirdly. Between the Tide Gates and the first Suspension Bridge, at the intersection of the Upper Barrackpoor Road, the Canal to have larger dimensions and depth, in order to form a Basin or Reservoir, in which Crafts may conveniently remain secure from the dangers of the River.

No. 89. *b.*

Manœuvring of the Gates.

1. The sill of the Chamber of the Gates, is made even with the bottom of the Canal, 8 feet below θ Zero, or Major Schalh's average Surface of the Lake, and 9 inches below the extreme Low-water mark of the River Hooghlee. The two outer pair of Gates (pointing outwards) to be $21\frac{1}{2}$ feet high, 1 foot more than the extreme annual rise and fall in the Hooghlee. The inner pair of Gates to be 14 feet high, pointing inwards. The breadth between the cheeks of the passages to be 24 feet, which will be found sufficient for the largest Boats.

2. The working of the Gates when all are free, on their hinges, will be thus :—

3. When the Tide commences to Ebb from the Canal towards the River, the Inner Gates will, of themselves, close, and prevent any fall of water or communication with the River.

4. When the Flood Tide again has risen to the level of the water in the Basin, which, in the interim, has lowered itself since the Inner Gates closed, by the passage of its water to the Salt Lake, the Inner Gates will open of themselves, and the Outer Gates close of themselves.

5. As however the closing of one set of Gates immediately on the opening of the others would leave no time for the passage of Boats, it is my intention to have the means of fastening the Gates back for any time, or indeed a whole Tide, when it is safe ; reserving the power, in case the stream should become too rapid for the safety of the Canal, of closing them, and diminishing the flow of water at any time while the Tide is flowing.

6. It is proposed to leave the inner pair of Gates, which point against the Ebb, always free to work of themselves, and to regulate the outer pair according to the state of the Tides in the River. To affix a gauge to the Gates themselves, or the masonry of the pier, and instruct the Overseer, (Native or European,) to set the Outer Gates free whenever the water rises to a certain mark, which will, I believe, be found to be near the mark, 6 feet above Zero. The regulation of this cannot be a difficult matter, nor at all beyond the capacity of a Native Peon or Classie.

7. An examination of the account of Tides in the annexed abstract from the Register will shew, that for the months of December, January, and February, the Outer Gates may remain entirely fastened back or even be unswung for repair, and that at the lowest state of the Flood Tide, the Inner Gates will be open for two to three hours, if not more. During the months of October, (the latter half,) November, March, April, and May, that the height of the Tides will allow of the Outer Gates being fastened back for the whole of the Neap

Scale to Plan.
100 200 300 400 500

Chitpoor Road

Proposed new road

Gates

Overlook

To Barrackpoor

BASIN
of 2000 ft length.

Mathatia Ditch.

Circular

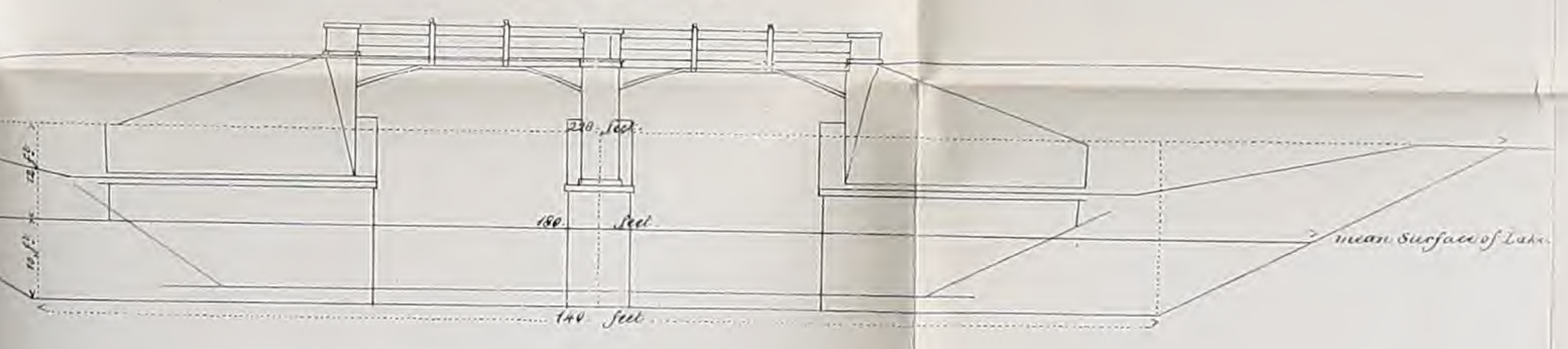
Bridge

Barrackpoor road.

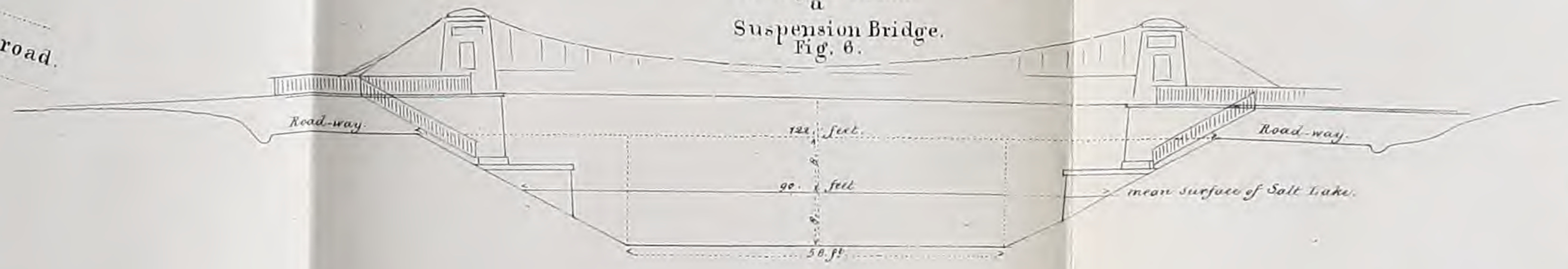
CANAL.

DESIGN
for a
SYSTEM OF TIDE-GATES
to be constructed at
the opening of the
Circular Canal.
by
The Principal Engineer

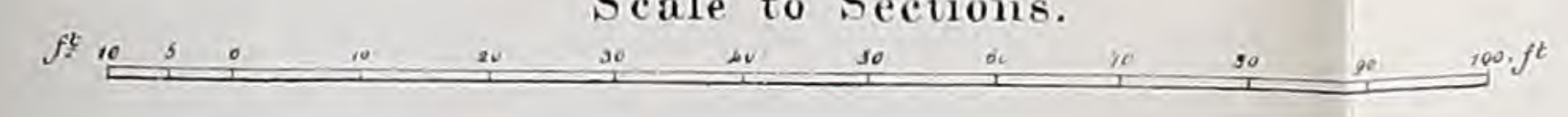
Fig. 5.
SECTION OF BASIN.
Showing in distance
The Outer Gates.



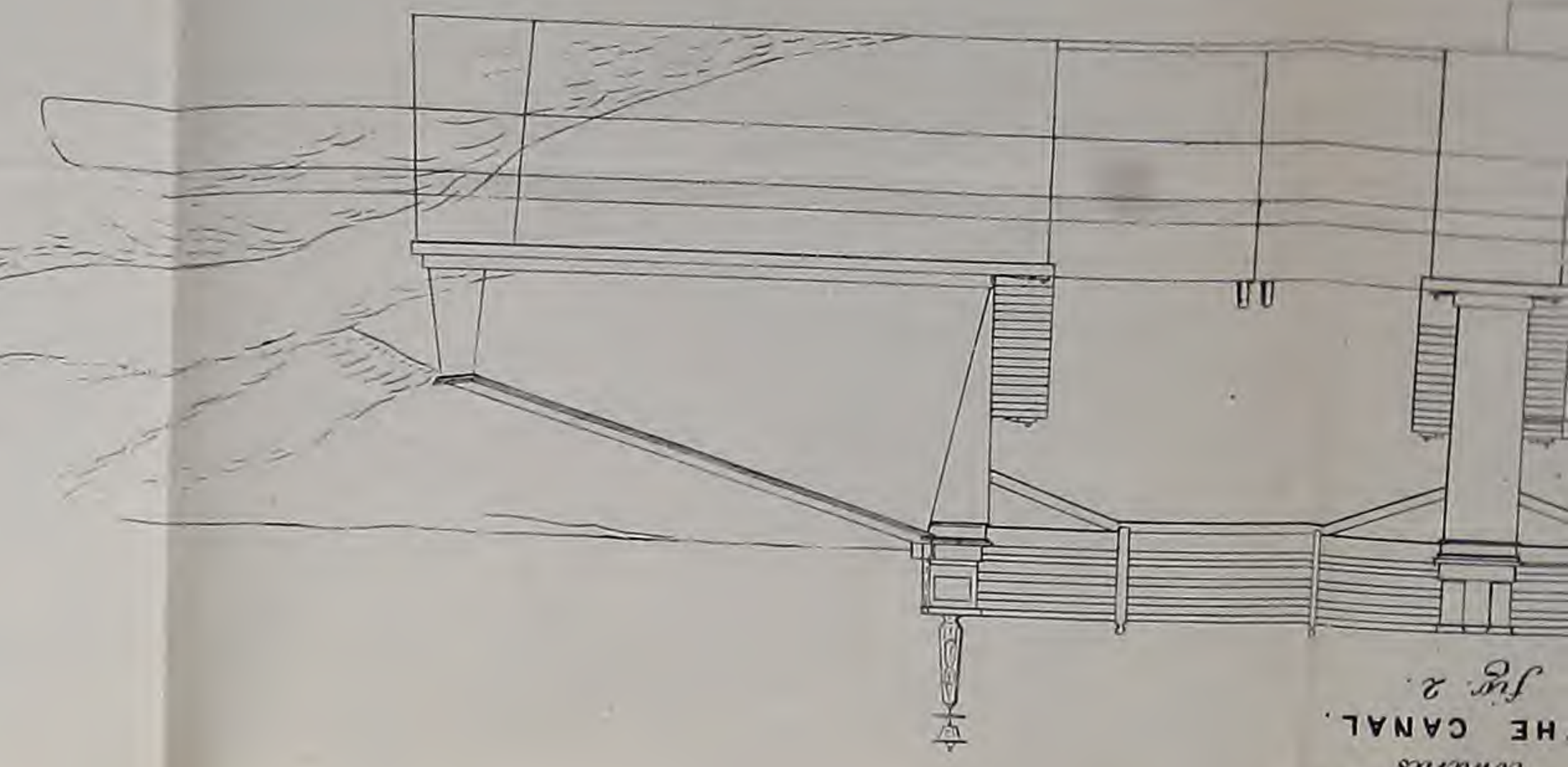
GENERAL SECTION OF CANAL
Showing in distance
a
Suspension Bridge.
Fig. 6.



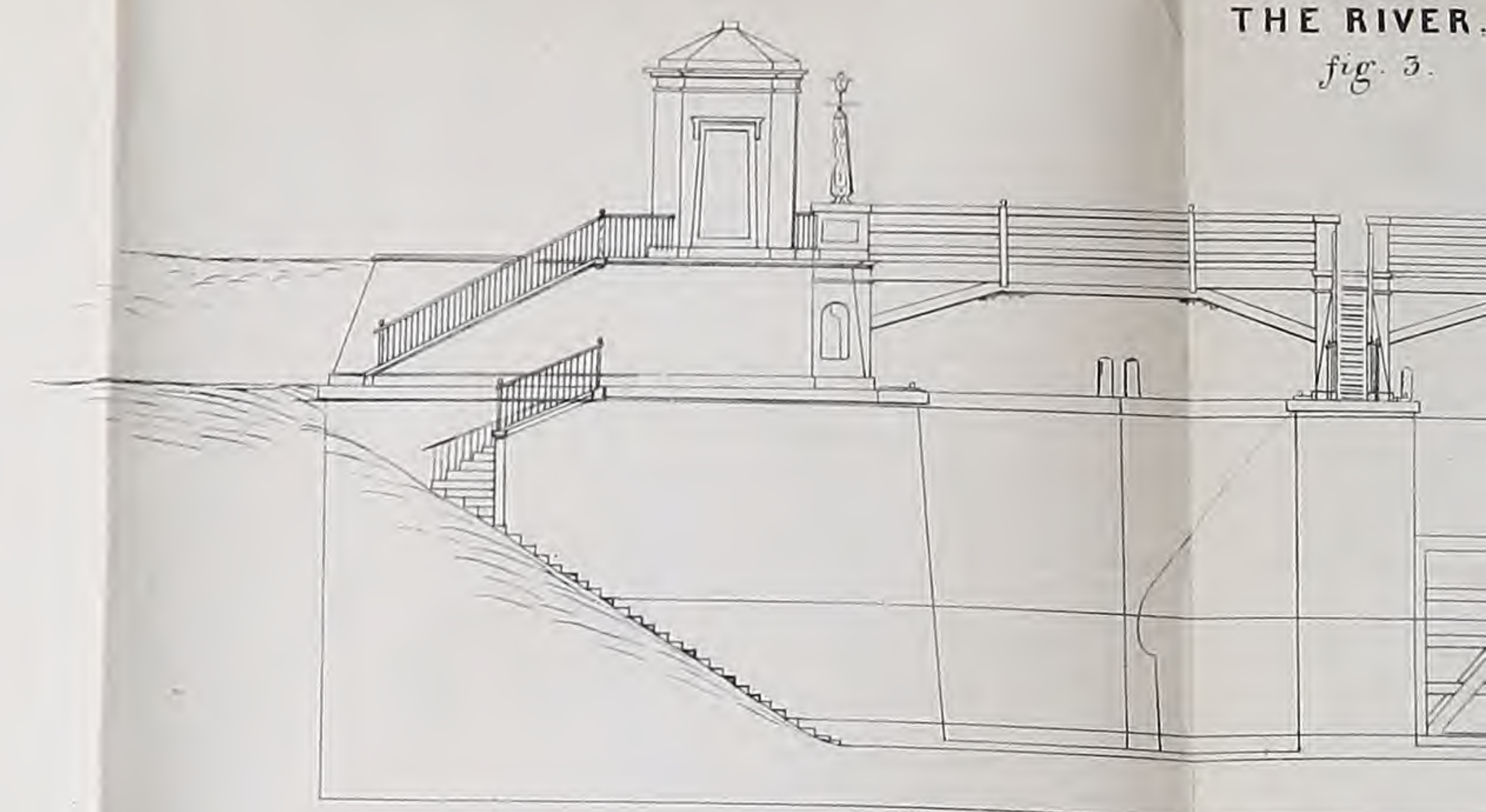
Scale to Sections.



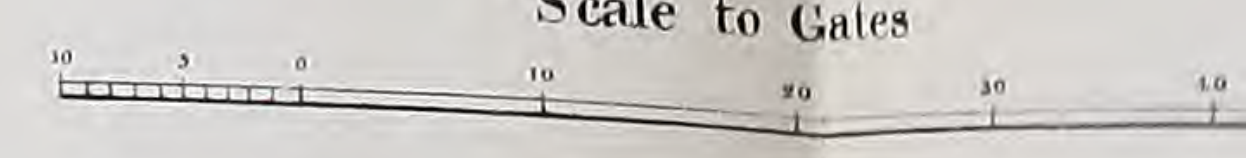
ELEVATION
towards
THE CANAL.
Fig. 2.



ELEVATION
towards
THE RIVER.
Fig. 3.



Scale to Gates



AT DOOR HALL

Chitpoor Road
Proposed new road

Scale to Plan.
100 50 0 100 200 300 400 ft

To Barrackpoor

BASIN
of 2000 ft length

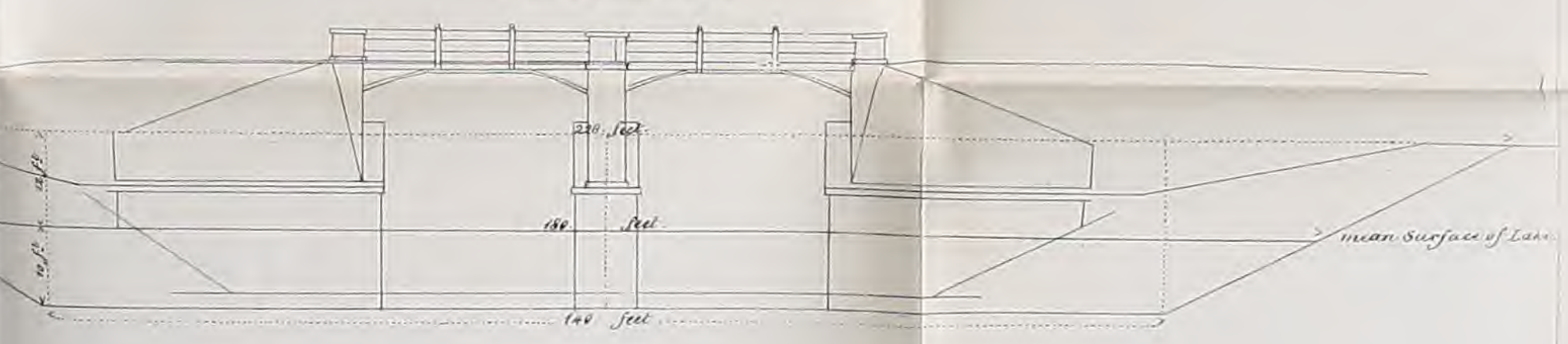
Marhatta Ditch

Circular

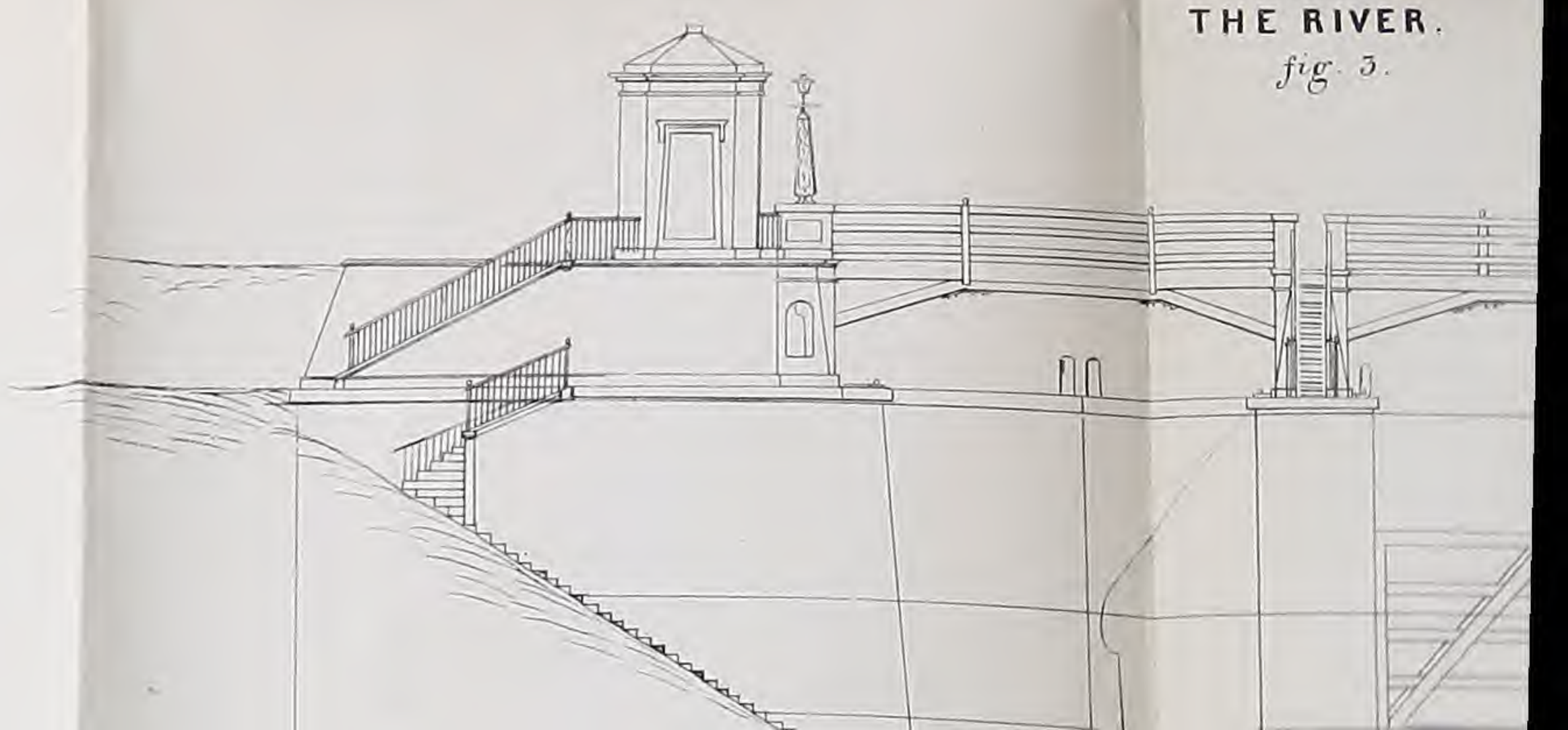
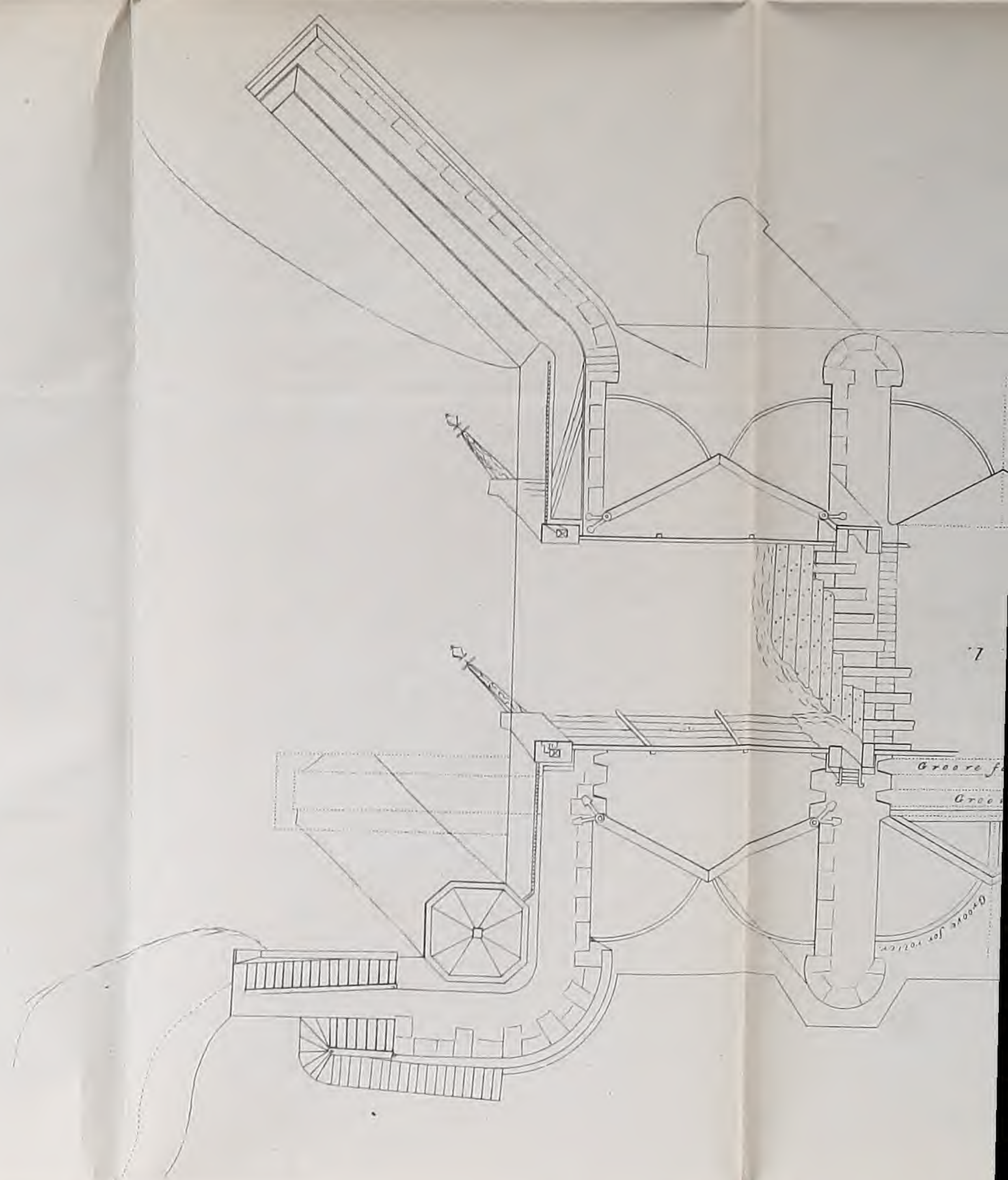
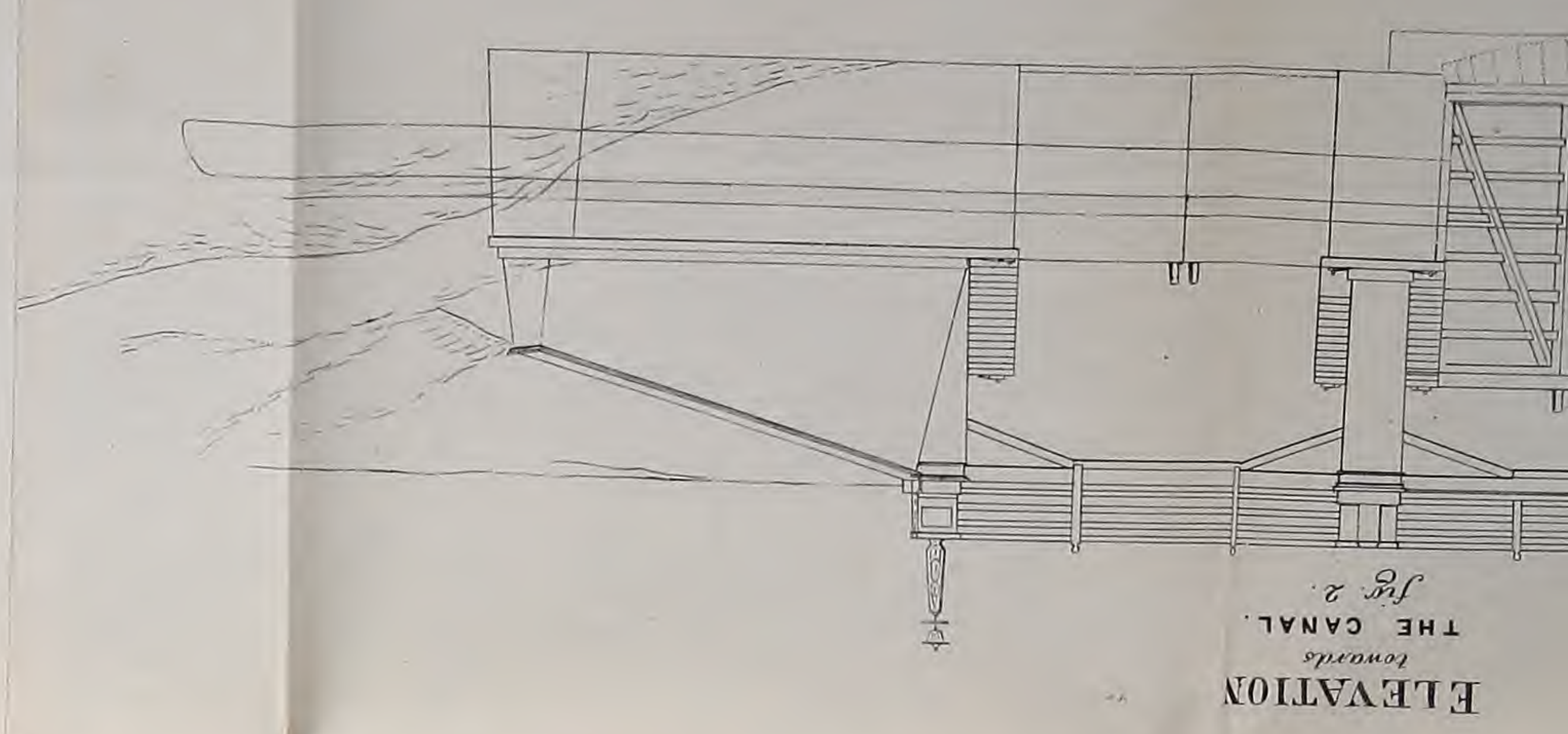
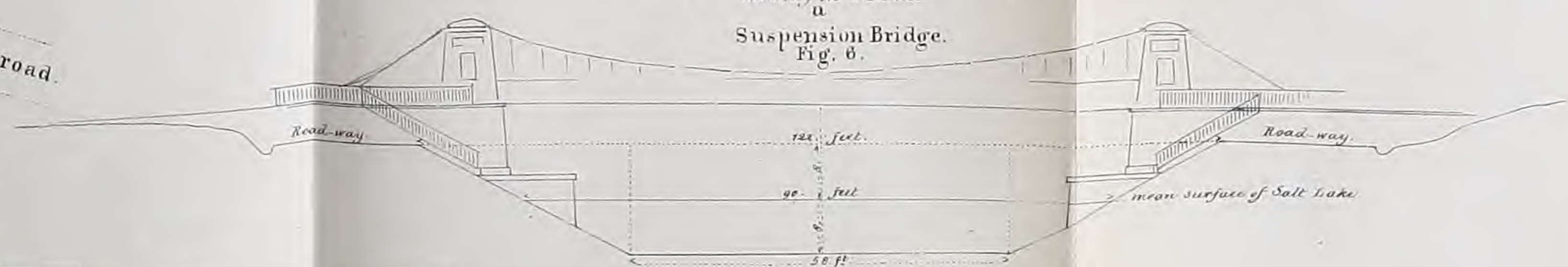
Barrackpoor road

DESIGN
for a
SYSTEM OF TIDE-GATES
to be constructed at
the opening of the
Circular Canal
by
The S. P. & C. Co. Ltd.

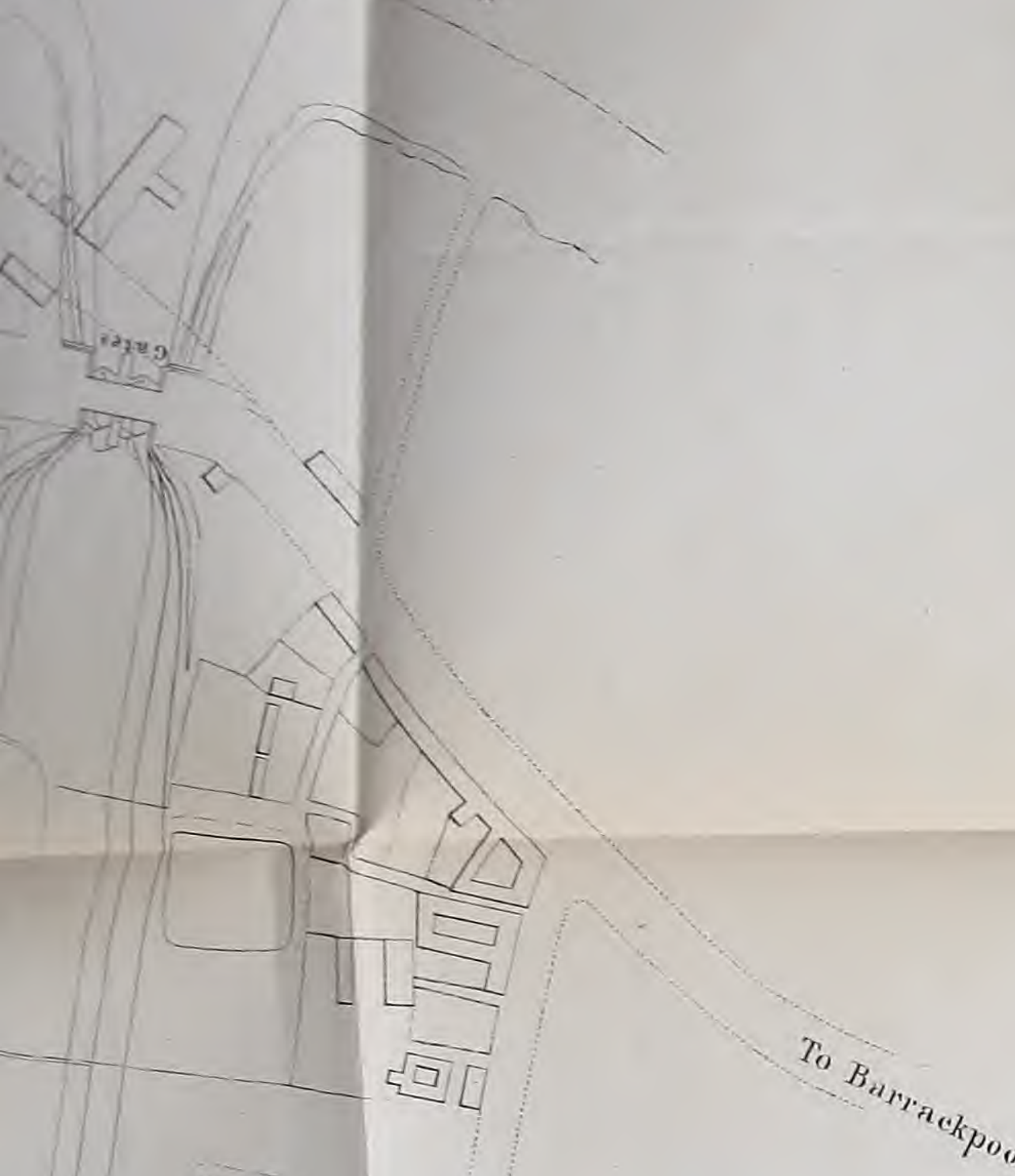
Fig. 3.
SECTION OF BASIN.
Showing in distance
The Outer Gates.



GENERAL SECTION OF CANAL
Showing in distance
a
Suspension Bridge.
Fig. 6.



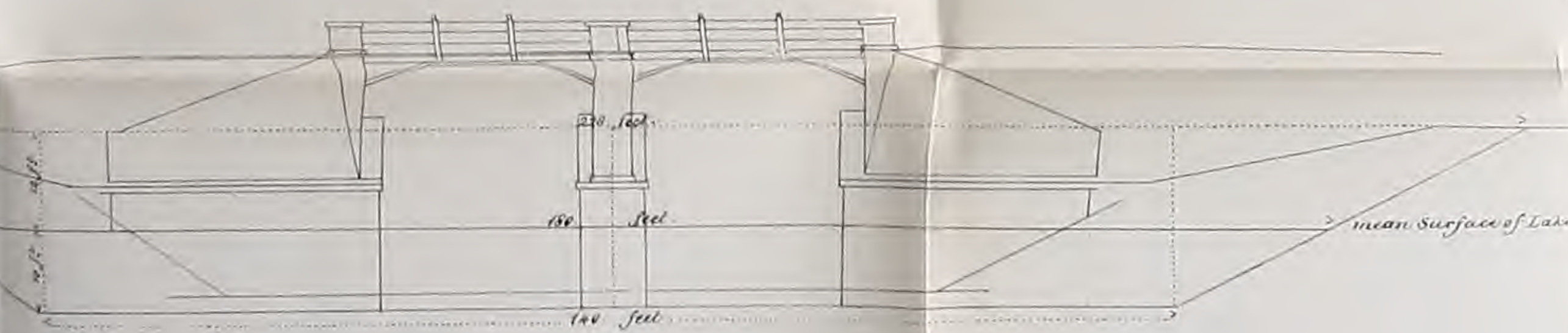
0 E
11 12 13



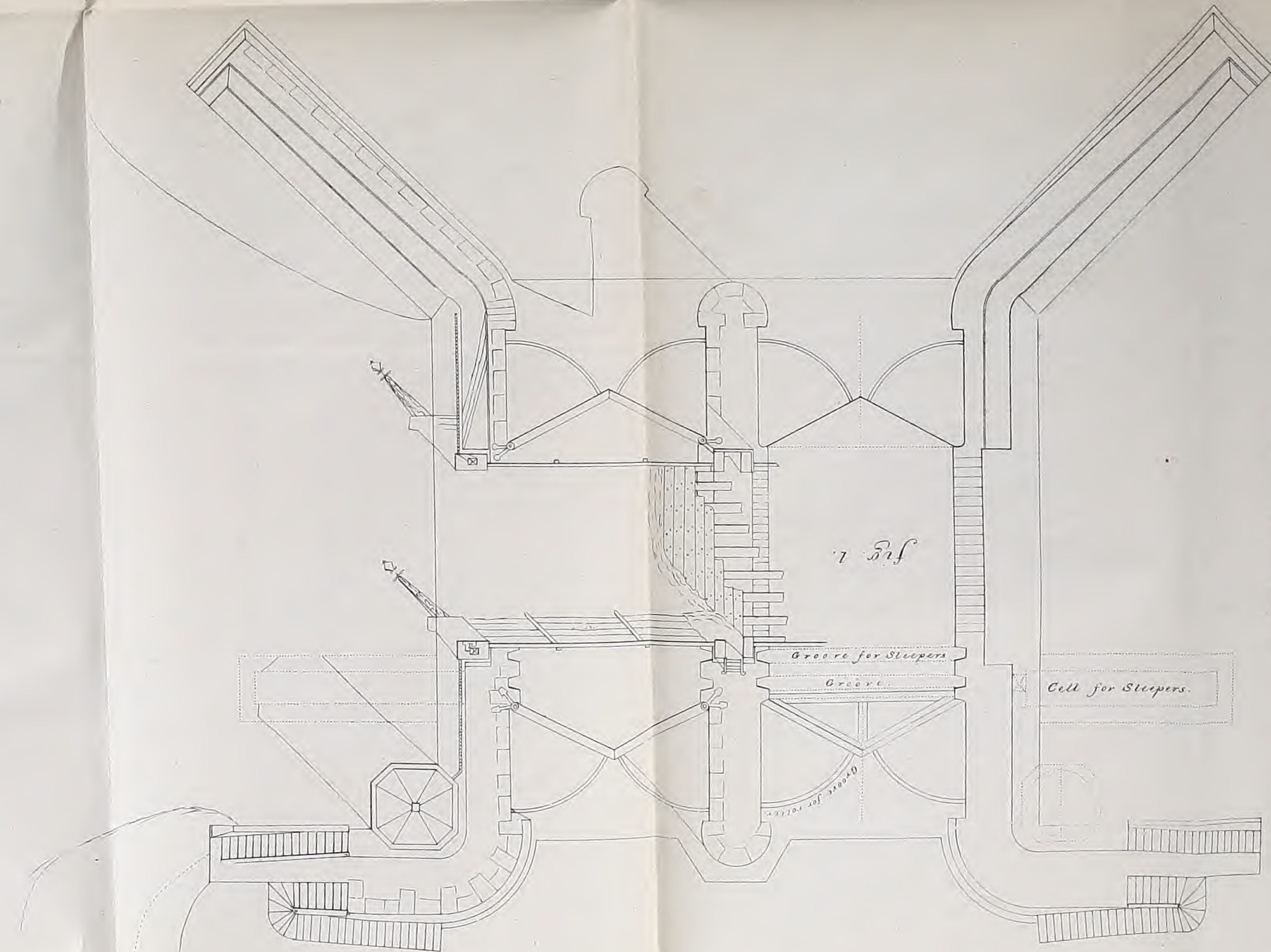
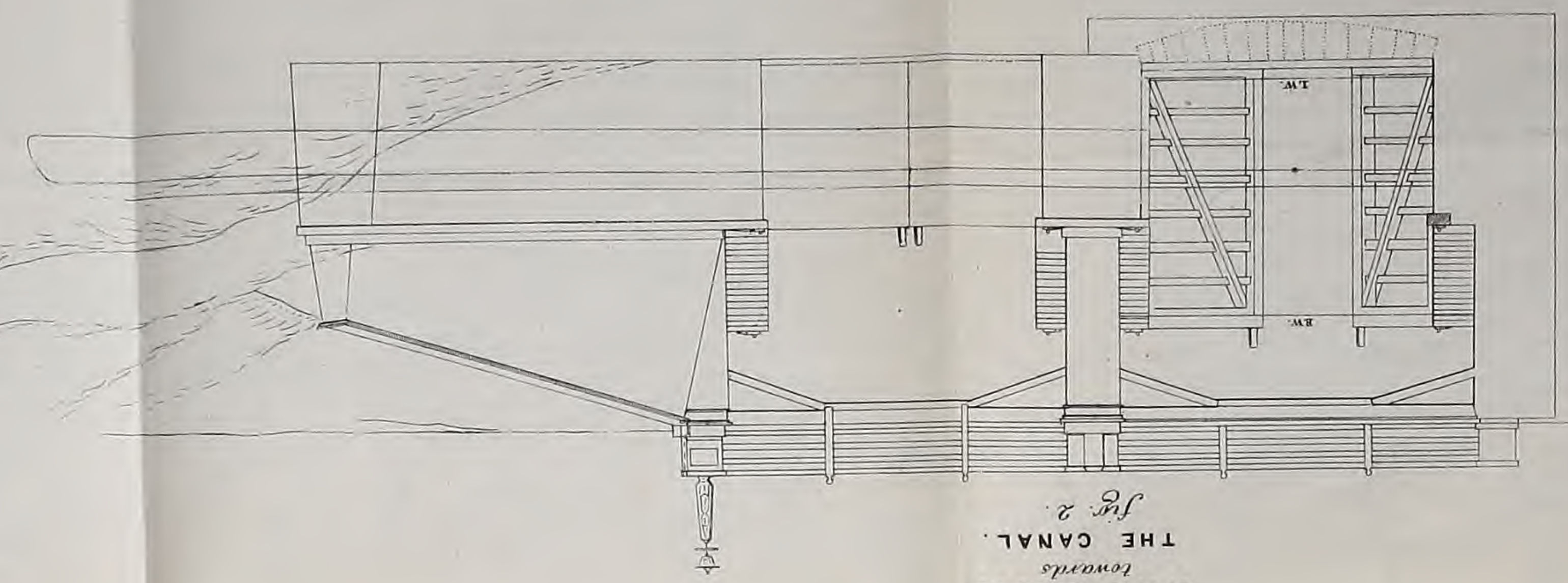
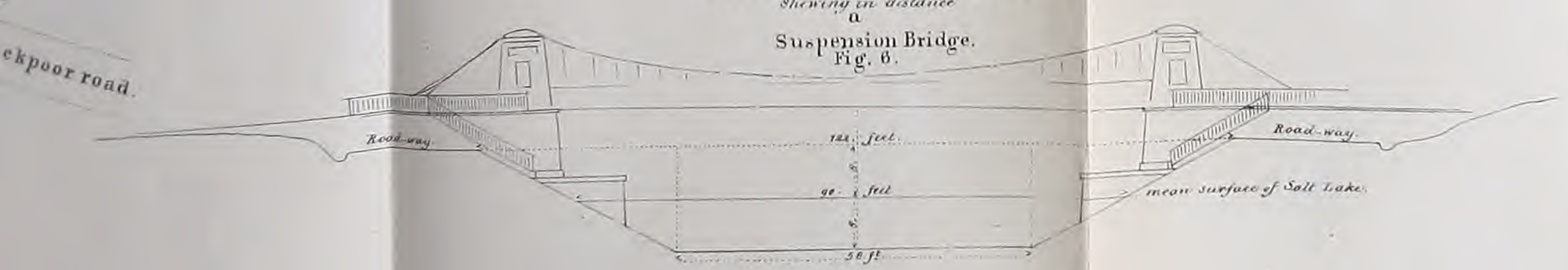
DESIGN
for a
SYSTEM OF TIDE-GATES
to be constructed at
the opening of the
Circular Canal.

By
The Barrackpoor Dock Co.

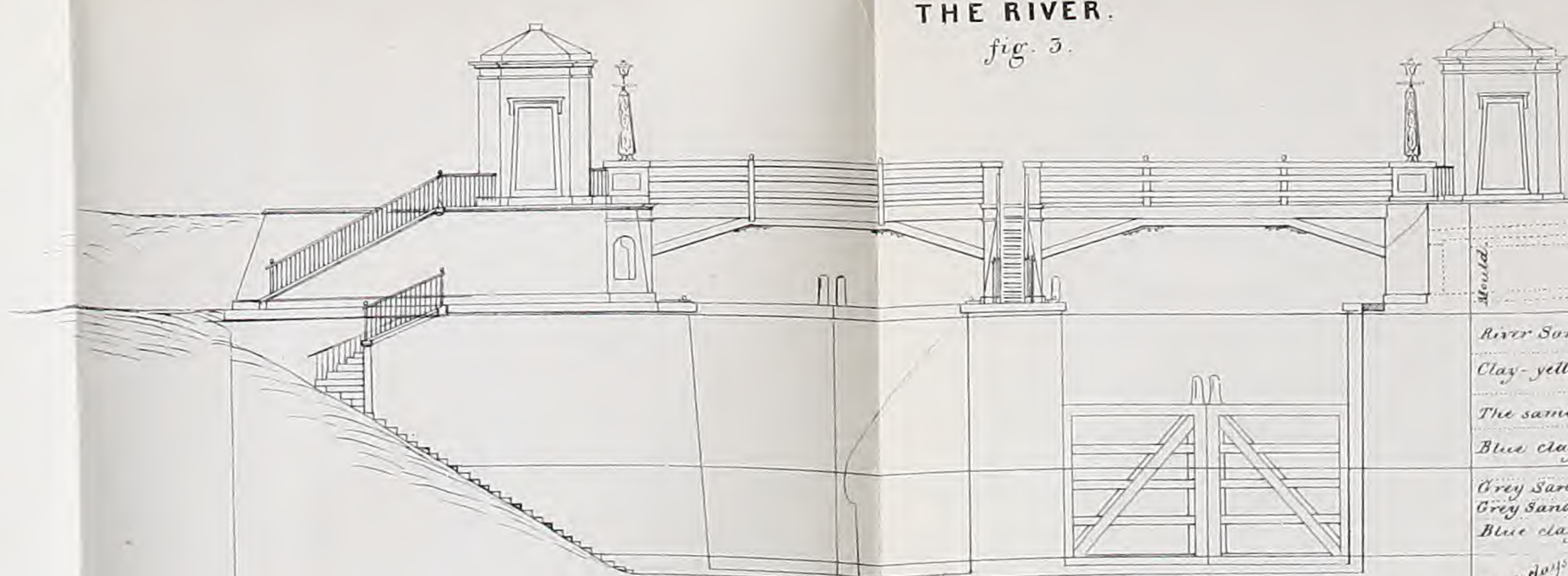
Fig. 5.
SECTION OF BASIN.
Showing in distance
The Outer Gates.



GENERAL SECTION OF CANAL
Showing in distance
a
Suspension Bridge.
Fig. 6.



ELEVATION
towards
THE RIVER.
fig. 3.



River Sand.
Clay - yellow.
The same with Sand.
Blue clay - soft.
Grey Sand.
Grey Sand and oge.
Blue clay - harder.

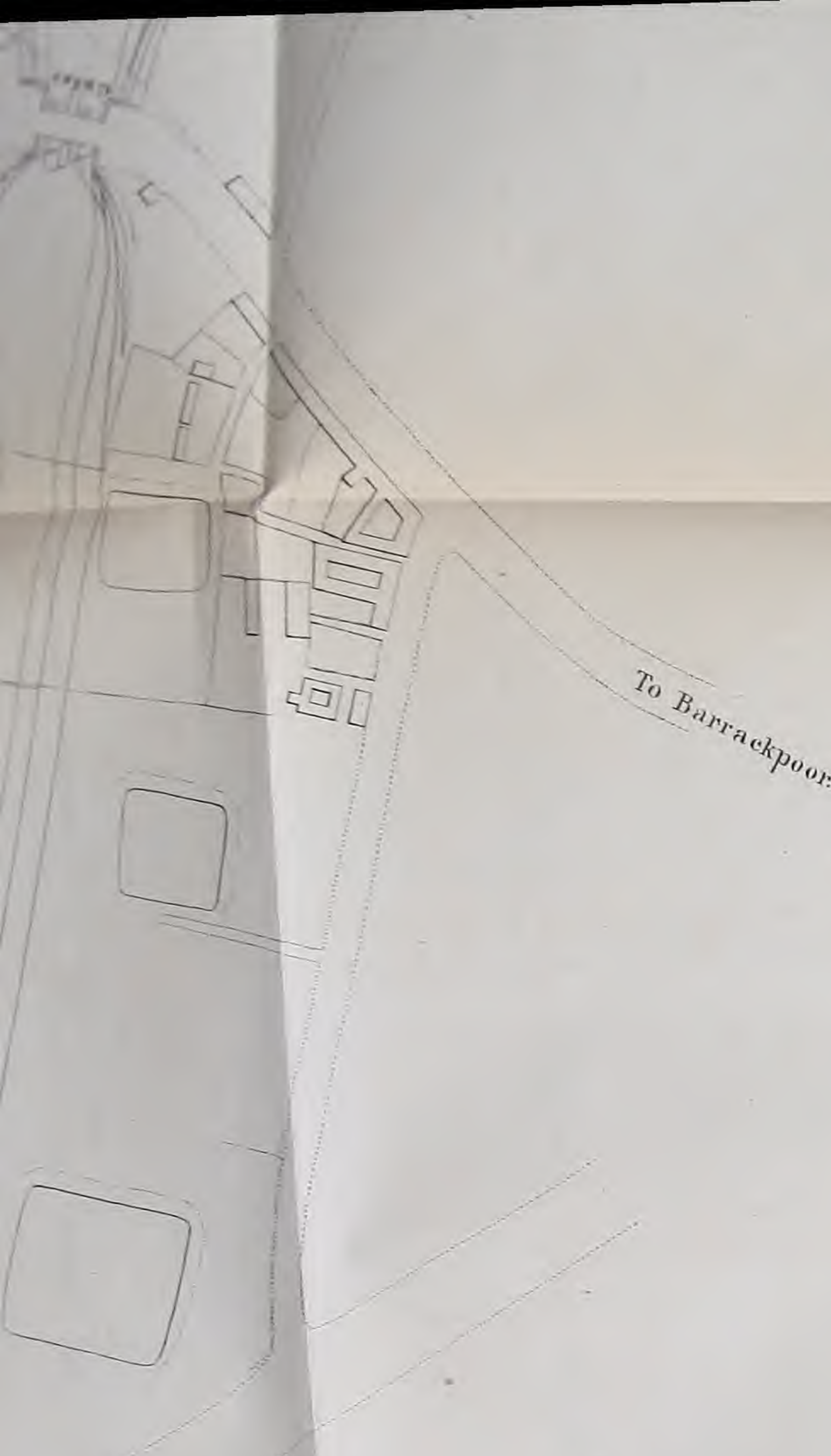
Extreme H.W. in the Hooghly.

Zero.

Extreme L.W. in the Hooghly.

BASIN.

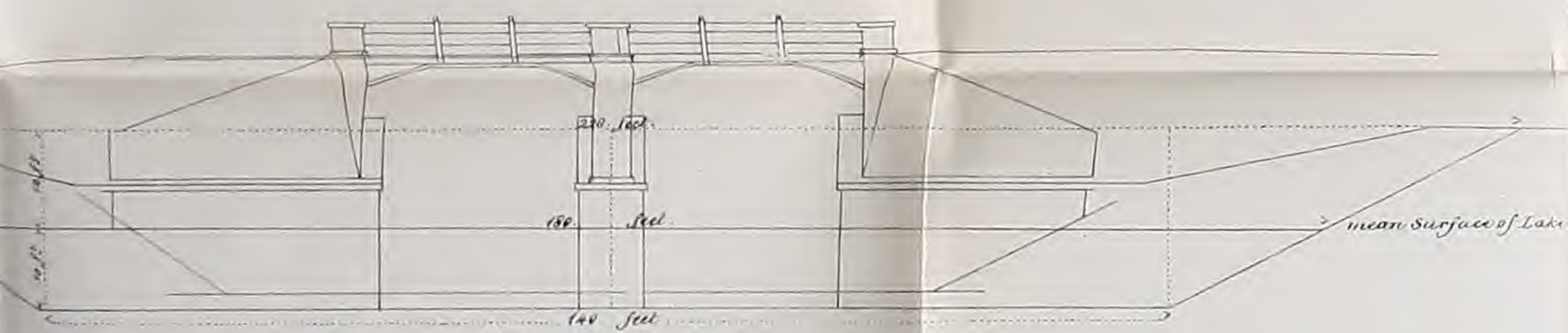
Extreme H.W. in the Lake.
Zero of level.
Extreme L.W. in the Lake.



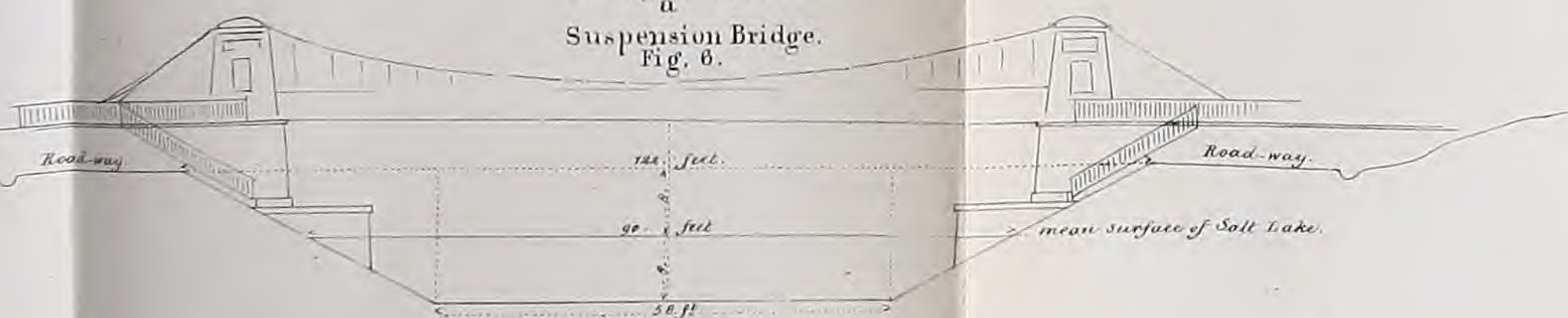
To Barrackpore.

DESIGN
for a
SYSTEM OF TIDE-GATES
to be constructed at
the opening of the
Circular Canal.
by
Thos. Winstanley Esq. C.E.

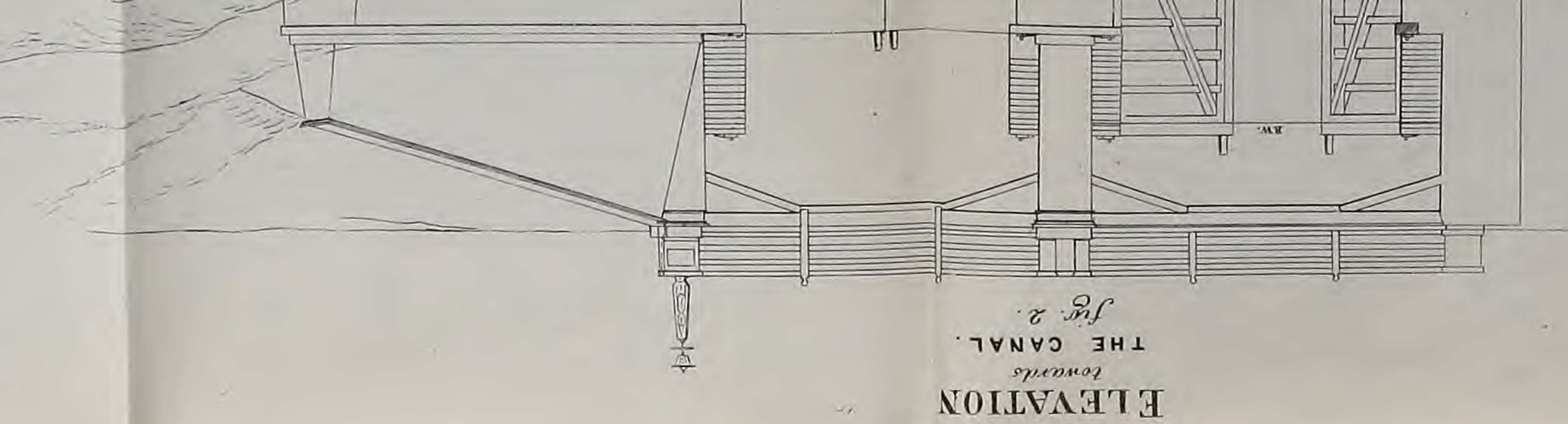
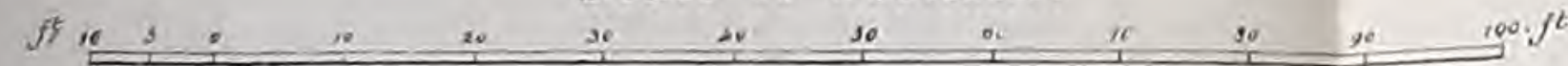
Fig. 5.
SECTION of BASIN.
Showing in distance
The Outer Gates.



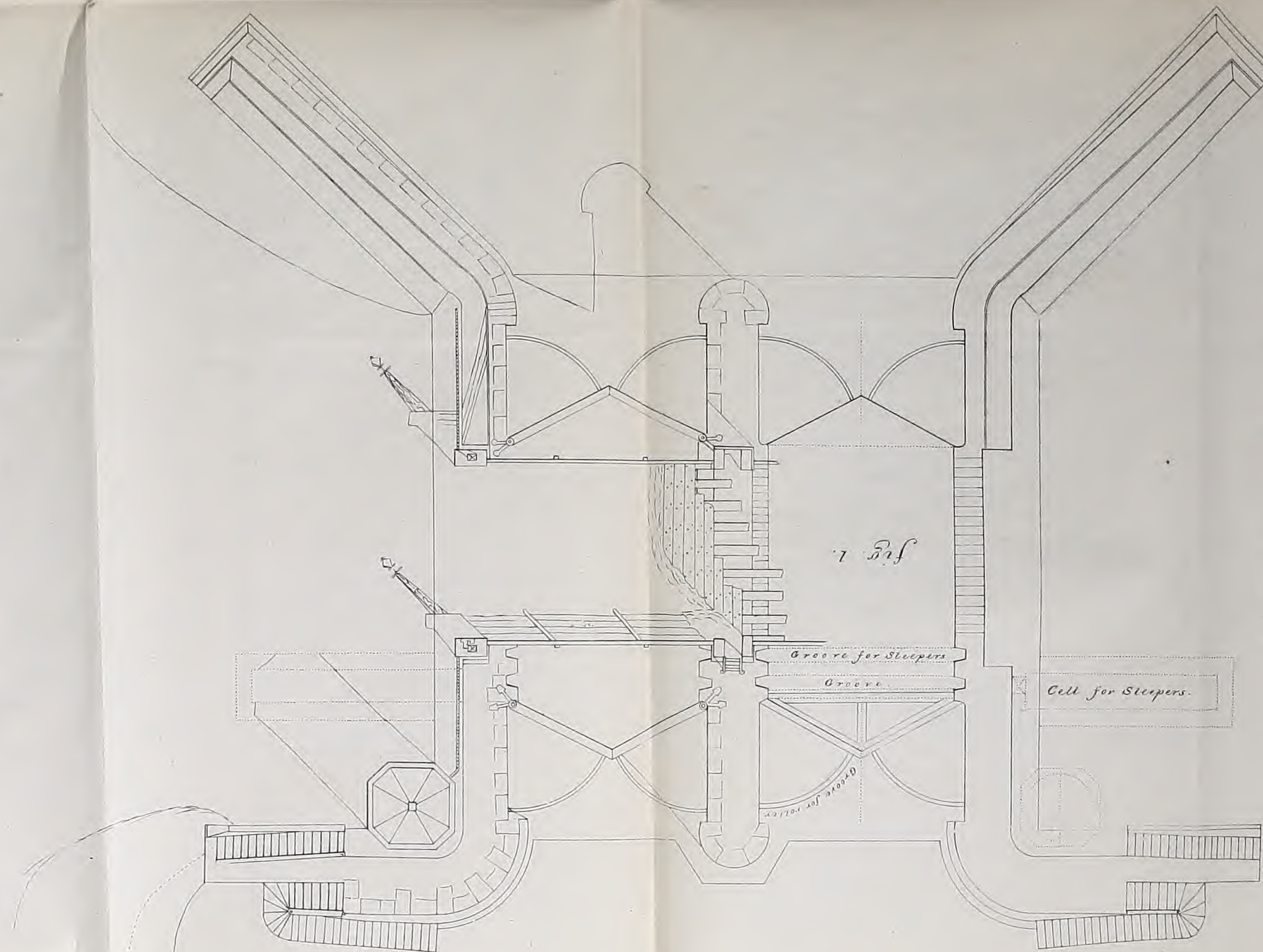
GENERAL SECTION of CANAL
Showing in distance
a
Suspension Bridge.
Fig. 6.



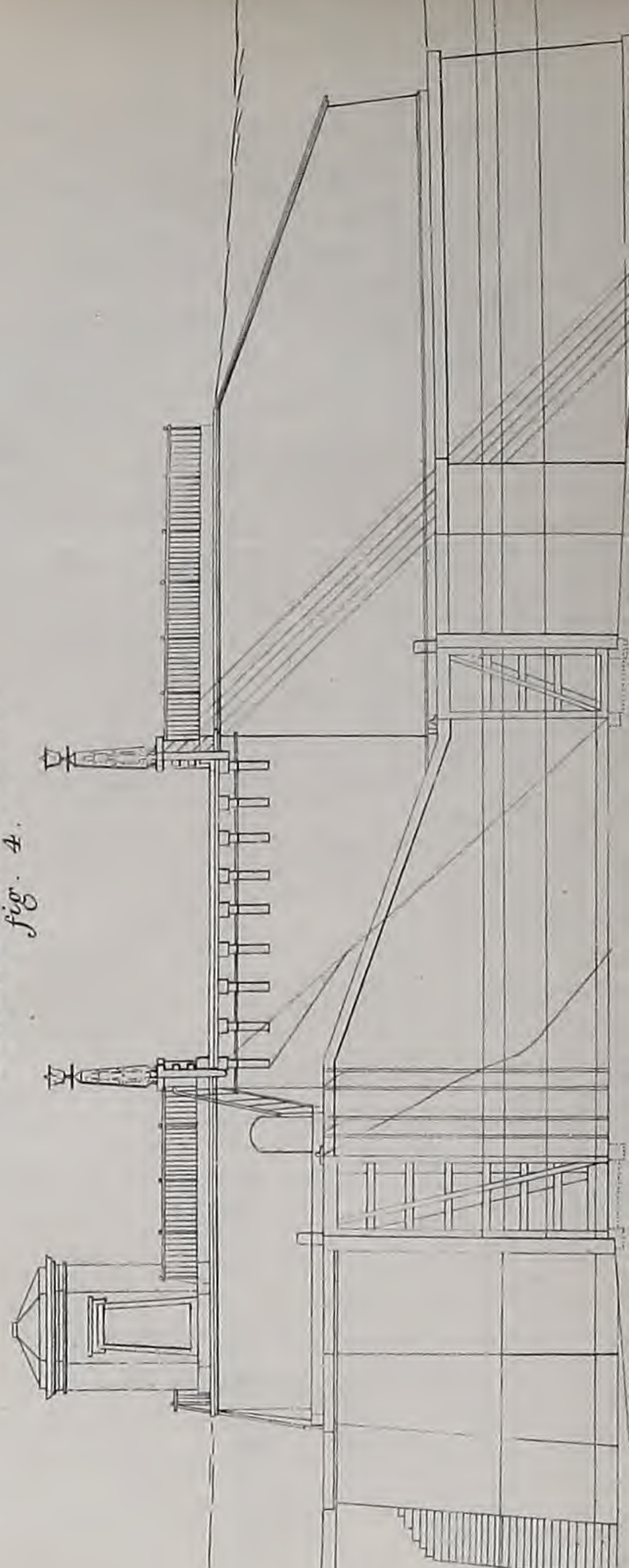
Scale to Sections.



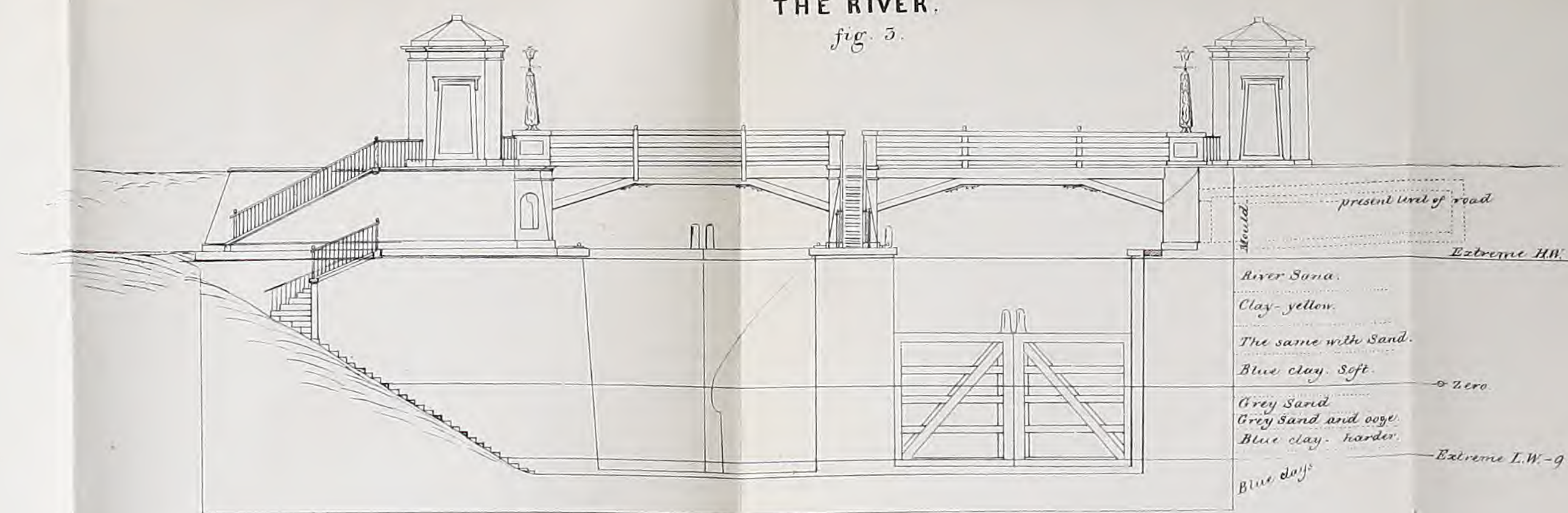
ELEVATION
towards
THE CANAL.
fig. 2.



LONGITUDINAL SECTION
fig. 4.



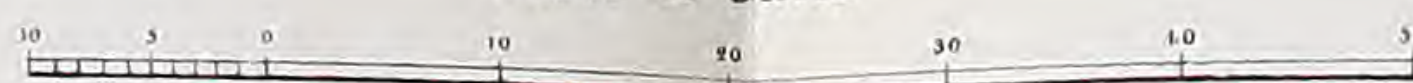
ELEVATION
towards
THE RIVER.
fig. 3.



River Sand.
Clay - yellow.
The same with Sand.
Blue clay, soft.
Grey Sand.
Grey sand and oge.
Blue clay, harder.
Blue clay.

Extreme L.W. - 9 inches above S.W.

Scale to Gates



Extreme H.W. in the Hooghly.

Zero.

Extreme L.W. in the Hooghly.

BASIN.

Tides, their closing being only necessary for the few days of Spring Flood; and that for the four remaining months of June, July, August, and September, it will still be possible to secure a communication daily for several hours, there being very few occasions when the Ebb in the River remains above what will be the level of water in the Basin and Canal.

8. As a safeguard against any accident or failure of the Outer Gates, when the River is at the highest, I have introduced grooves behind the Gates, such as are found in the descriptions of the system of Tide Gates, so much admired, connecting the Port of Ostend with the Canal of Bridges; and as the timbers will be ready at hand in the cell, which I have proposed to construct for the purpose of containing them in the Masonry of the Abutments, all danger may be prevented at the shortest notice, by lowering these timbers into the grooves, an operation that cannot occupy many hours.

Construction.

9. As the foundations of the Pier and Abutments sink below the bad stratum of Sand, after which I have found a solid dark blue clay, I have, instead of timber, drawn an inverted arch of brick under the Gates, to form the flooring of the passage. This construction will be found more durable, and less expensive. Immediately in the bearing of the Gates, a strong frame of timber, (teak,) must be imbedded in the Masonry.

10. The Bridges over the passages, I have drawn of the simplest and most economical nature. If, however, it is thought worth the additional expense, Draw or Swing Bridges may be substituted, by which means, Pinnaces or Boats of any description, may pass into the Basin with their masts and rigging.

11. I have not inserted in the Plate, either any Culvert in the Masonry of the Piers or Hatches to any of the Gates. It may, however, be an improvement to construct something of the kind, in order to obtain a means of clearing the aprons of the Gates at Low-water.

(Signed) THOS. PRINSEP.

(True Copy,)

J. N. JACKSON,
Secretary, Canal Committee.

No. 89. c.

Estimate of the probable Expense that will attend the construction of Tide Gates and Bridges, according to the Plan described in the accompanying Plate.

To Excavating in quantity, 500 Chowkas at 2/8,	Rs. 1,250	0	0
„ Expenses in raising water, puddling against the Oozing Sand Stratum, and keeping the work constantly dry, estimated at most,	5,000	0	0
„ Superstructure in Abutments and Pier, containing on measurement 63,600 cubic feet, at 20 Rs. per 100 feet,	12,720	0	0
„ Foundations with inverted Arches, containing on measurement 24,600 cubic feet, at 25 Rs. per 100,	6,150	0	0
„ Coping Stones, Chunar, 9 inches thick, in all 557 cubic feet at 2 Rs., ..	1,114	0	0
„ 118 Running feet of Iron Rail, plain, at 5 Rs.,	590	0	0
„ Four Iron Lamp Posts complete, at 100 Rs. each,	400	0	0
Expenses of 2 plain Wooden Bridges of 28 feet span.			
18 Large Saul Beams, at 60 Rs. each,	1,080	0	0
18 Lower to upper,	1,080	0	0
1,364 Square feet Planks, at 12 annas,	1,023	0	0
124 Running feet Wooden Rail,	200	0	0
	3,383	0	0
„ Expense of two outer pair of Gates, 21½ feet high, 15 feet wide, each door with timber grooves and aprons, brass coppered,	8,000	0	0
„ Expenses of two inner pair of Gates, 14 feet high, 15 feet wide, &c. and complete,	5,000	0	0
„ Expenses in Road-way of approach, &c.	2,000	0	0
„ A Culvert in centre Pier if necessary, with draw hatches, or otherwise a hutch in gates,	500	0	0
„ Three neat Windlasses or Crabs to the Outer Gates,	600	0	0
„ Ditto ditto for Inner Gates,	600	0	0
„ 80 Saul Timbers to fit grooves at 50 Rs. each,	4,000	0	0
Contingencies, Supervision, &c.	8,693	0	0
	60,000	0	0

(Signed) THOS. PRINSEP, *Captain, Engineers.*

(True Copy,)

J. N. JACKSON,

Secretary, Canal Committee.

General Estimate for the probable Expenses attending the construction of the Circular Canal, agreeable to the Scheme proposed by Major SCHALCH in the Memoir and Appendix.

Excavating 17,100 running feet of Canal.

Average depth 22x mean breadth 108=2376 Section= in all 4,06,29,600 Cubic feet, or 55,733 Chowkas, @ 2 Rs. ..	1,11,466 0 0
Excavating 2,000 running feet of Basin, containing 11,105x1,448=12,553 Chowkas, @ 2 Rs. ..	25,106 0 0
Ditto from Basin to River, containing 1,029 Chowkas, @ 2 Rs. ..	2,058 0 0
Total Excavation, ..	1,38,630 0 0
Add. Estimate for 5 Bridges, @ 20,000 each, ...	1,00,000 0 0
Add. Ditto for Road, &c. ...	60,000 0 0
Add. Extra Expense for Sleeper Dams, omitted in Major Schalh's Original Estimates, ..	5,000 0 0
Sicca Rupees	3,03,630 0 0

NOTE.—The average rate of excavating is here assumed to be 2 Rs. per Chowka. I should question whether it could be excavated under average 2/8, and as the extra depth of 6 feet will influence this average, the rate of Major S's, Scheme should be 2/12, where Lieutenant P. is 2/8, and the two first items become, 1,90,616 4 0 and 1,14,777 8 0

(True Copy,)

J. N. JACKSON,

Secretary, Canal Committee.

(Signed)

THOS. PRINSEP, Captain.

General Estimate for the probable Expenses attending the construction of the Circular Canal, agreeable to the Scheme now proposed by Lieutenant PRINSEP, Engineers.

Excavating 17,100 running feet of Canal.

Average depth 16x mean breadth 90=1,440 feet Section, in all 2,46,24,000 Cubic feet, or 33,777 Chowkas, @ 2 Rs. ..	67,554 0 0
Excavating 2,000 feet of Basin, containing 11,105 Chowkas, @ 2 Rs. ..	22,210 0 0
Ditto from Basin to River, 1,029 Chowkas, @ 2 Rs. ..	2,058 0 0
Total Excavation, ..	91,822 0 0
Add. Estimate (old) for four Bridges, ..	80,000 0 0
Add. ditto ditto for Roads, ..	60,000 0 0
Add. ditto for Tide Gates, ..	60,000 0 0
Sicca Rupees ..	2,91,822 0 0

No. 90.

No. 203.

To H. T. PRINSEP, ESQ.

Acting Secretary to Government, Territorial Department.

SIR,

I have the honor, by desire of the Canal Committee, to transmit for the consideration of the Right Honorable the Governor General in Council, the Copy of a Letter and Memoir, with a Plan in original, submitted to them by Captain T. Prinsep, Superintendent of Canals, dated the 31st ultimo, on the subject of the proposed Canal of Communication between the Hooghly at Chitpore and the Balliaghaut Canal, and suggesting certain alterations in modification of the Plan of that work, as prepared by the late Major Schalch.

In the judgment of the Committee, the Memoir contains much important and valuable information; but as the proposed deviations from the Original Plan sanctioned by Government are very considerable, although the aggregate amount of expense will not thereby be increased, they are induced to refrain from recommending the immediate adoption of Captain Prinsep's suggestions, conceiving it probable, that Government may deem it expedient to refer the subject to such other Officers at the Presidency, as may be qualified to offer their opinions upon it; such a proceeding would prove satisfactory to the Committee, as well as to the Superintendent, Captain Prinsep, who has expressed his entire acquiescence in the measure.

I have the honor to be,

Sir,

Your most obedient servant,

J. N. JACKSON,

Secretary, Canal Committee.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
19th November, 1827.

No. 93.

To MAJOR J. N. JACKSON,

Secretary, Canal Committee.

Revenue, 6th December, 1827.

SIR,

I am directed by the Right Honorable the Governor General in Council, to acknowledge the receipt of your Letter, dated the 19th ultimo, submitting a Memoir from Captain Prinsep, Superintendent of Canals, on the proposed Canal between the River Hoogly and the Salt Water Lake; and suggesting certain alterations in modification of the late Major Schalch's Plan.

2. Though on the whole favorably disposed to the alteration of [the] Plan suggested, which seems to be founded on correct principles and calculations, His Lordship in Council, nevertheless entirely concurs in the expediency of consulting other professional persons before finally determining on a point of so much importance to the success of the work, as the proposed attempt to use sluice gates at the Point of Communication with the River.

3. His Lordship in Council accordingly desires, that you will consult with such Engineer Officers as you may consider best qualified to give a sound opinion on the subject,

and likewise that you will solicit information from such other persons, as from having been engaged in Superintending or Constructing Docks and Tide Gates for Shipping, you may deem competent judges of the practical parts of the Plan brought forward by the Superintendent of Canals.

4. It may be advantageous in many respects, and will assist the Governor General in Council, in forming a clearer perception of the questions involved, that your Committee should frame a series of distinct interrogatories to be submitted to the persons whom you may deem it proper to consult, and these with the answers, you will of course submit, together with your own sentiments on the most material points ultimately referred, for the determination of His Lordship in Council.

5. The original Plan which accompanied your Letter, is herewith returned.

I am, &c.

(Signed) H. T. PRINSEP,
Secretary to Government.

No. 94.

No. 1845.

To MAJOR J. N. JACKSON,

Secretary, Canal Committee.

SIR,

I am directed by the Right Honorable the Governor General in Council, to transmit for the information of the Canal Committee, the subjoined Extracts, (Paragraphs 87 to 91,) from a Dispatch from the Honorable the Court of Directors, under date the 11th July, 1827.

I am &c.

COUNCIL CHAMBER,
The 13th December, 1827.

(Signed) H. T. PRINSEP,
Secretary to the Government.

No. 94. a.

Extract from a General Letter from the Honorable the Court of Directors in the Revenue Department, dated 11th July, 1827.

228 to 259. Proceedings for investigating and carrying into execution Lieut. Schalch's Plan for opening a permanent communication between the Hoogly and the great River. Formation of a Committee to investigate and controul. Proposal entertained for making a Navigable Cut from Calcutta to Channel Creek. Purchase of a Steam Engine for Excavating Canals. The Eastern Canal to be cleared at the expense of Rs. 9,785, and a temporary Bridge of Iron to be erected at Rs. 1000. A Suspension Bridge to be thrown over Tolly's Nullah at an expense of 39,975. Rs.

87. The idea of the first of these undertakings, that of forming an improved communication between the Hooghly and the great River was previously communicated to us, and the Plan held out the promise of so much advantage, that we expressed an opinion favorable to the design of fully investigating the project. From the voluminous documents before us, we have the satisfaction of perceiving, that you took such measures as appear to us to have been the most effectual in your power for securing the due performance of the investigation by the formation of a Committee, who appear to have

carefully examined the statements and reasonings of the projector, and called for information on every material point from all such quarters as were presumed the most likely to afford it. The evidence which was thus brought before you, justified in our opinion, the conclusion which you derived from it, that the undertaking was expedient, and the advantage likely to afford compensation for the expense.

88. We agree with you fully in the principle, that to afford the means of cheaper communication is one of the greatest services which can be rendered to the community. And it is only necessary by just calculation to ascertain in the case of any project, that the expectation of creating cheapness is well founded, for as the cost incurred is the cost of the community, unless the annual benefit is more than equal to the interest of the expended Capital, the hope of greater cheapness is not fulfilled. The cost of this undertaking you calculate will be covered, including the charges of Superintendence, by $10\frac{1}{2}$ Lacs of Rupees. And you express a confident expectation, that such Tolls as will be cheerfully submitted to by the Mercantile Community, will not only yield the interest of this sum, but a much more favourable result. We agree with you, that is the proper test of the expediency of such an undertaking, as what the community voluntarily pay for an accommodation, will at any rate not be greater than the advantage it affords them.

89. As one of the difficulties attending the execution of public works on a great scale, is to prevent the misapplication of the funds through negligence or incapacity, as well as fraud, we much approve the care you seem to have bestowed on this material object, by the formation of a Committee of Control,* under whom the Superintending Officer is to execute his duties, and through whom the correspondence with Government is to be carried on; the care of Government will be limited to the duty, but that a very important one, of infusing the due spirit of vigilance into the Superintending Body, and taking care that it is properly maintained.

90. While you were engaged in the inquiries relative to this important work, another of a similar kind, was suggested to you; first by a communication from Mr. Wood, and afterwards by a Plan and Estimates from Lieutenant Schalch, for making a Navigable Cut from Calcutta to Channel Creek. The reflections which we have offered on the preceding Scheme, apply so exactly to this undertaking, that it would be superfluous to repeat them. The circumstances laid before you in evidence, seemed sufficiently to establish the utility of the measure, the cost of which you have limited to 5 Lacs of Rupees. The conduct of this work is put under the same management as the former, and we think with every prospect of a favorable result.

91. The arrangements you made with respect to establishments; the purchase of a Steam Engine for Dredging, which was to be obtained on favorable terms; the disbursements authorized for deepening Tolly's Nullah and the Eastern Canal; and for constructing the requisite Bridge, seem entitled to approbation, and we are unwilling to lengthen this Despatch by observations which you may anticipate on certain parts of the detail. In concluding the subject, we trust, that the interruption which this and other public works may have suffered from the War, has been so managed, as that they may be resumed without intermediate damage, and the consequent waste of any part of the funds which may have been previously expended.

A True Extract,

TERRITORIAL DEPARTMENT,
The 13th December, 1827.

(Signed) H. T. PRINSEP,
Secretary to the Government.

* Consisting of 2d Member of the Board of Revenue, the Superintendent of Police, the Judge and Magistrate of the Suburbs of Calcutta, and the Superintendent of Buildings in the Lower Provinces.

No. 95.

(Copy.)

(No. 1456.)

To MAJOR J. N. JACKSON,

Secretary to the Canal Committee.

SIR,

I have the honor to acknowledge the receipt of your Letter, No. 18, of the 7th ultimo, with its enclosure, except the Plan alluded to, which may perhaps be on its way by Dawk Banghy, and if so, not likely to arrive for a month; yet, in its absence, I have endeavoured to answer the questions put, with reference to the ideas I have formed of the Plan from the description, but my experience connected with the Canals in this part of the Country bears but little on the cases put, and my answers are chiefly mere opinions, which a more intimate acquaintance with the subject, localities, &c. further enquiries, necessary if I had to do the work myself, might cause me to alter, they must consequently be received with this impression.

I have, &c.

DELLEE CANAL OFFICE IN CAMP,

SHAHPOOR,

10th March, 1828.

(Signed)

JOHN COLVIN, *Captain,**Superintendent of Canals, Dellee Territory.*

(A True Copy.)

(Signed)

J. N. JACKSON.

No. 95. a.

[*Questions put by the Committee appointed to control and direct the execution of Lieutenant SCHALCH's Plan of a line of Canal from the River Hoogly to Koolna, to Captain JOHN COLVIN, Superintendent of Canals, Dellee Territory, with his Answers thereto.*]

Question 1. Allowing the correctness of the statement of the variations of the Tides in the River and Salt Lake annexed to the Memoir of the Superintendent of Canals, whether it is your opinion that the preference should be given to a system of Tide Gates in managing the communication between the two levels, or to a free ingress and egress of the Tides for the (9) nine months, November to July, putting aside the question of dangers, inconvenience to the Drainage of the Town, or wear and tear of the Banks of the Canal, and merely considering the relative advantages of Navigation in a Canal preserving nearly an even level of surface and gentle (or perhaps no) Current of Water, or in a Canal where the variation of surface and rapidity of Current are considerable?

Answer. In answer to the question as stated, I have no hesitation in giving my opinion in favor of the system of Tide Gates, over that of an open communication for nine months in the year, but I think Tide Gates alone will hardly fully ensure the passage all the year round.

Q. 2. Whether you consider that the principle laid down by the Superintendent in the accompanying Letter, "that a system of Tide Gates will in the end be found both the least expensive and only efficient method of preserving the constant Navigation of any small Canal or Stream, which disembogues into a large Tide River, exhibiting so great

daily, as well as annual, variation of surface as the Hooglee," appears in your apprehension to be founded in truth?

A. I would say, the only efficient method of securing the constant Navigation would be a combined system of Tide and Lock Gates, as appears to me to be adverted to by the Superintendent in the article headed "Manœuvring of the Gates," Paragraph 1; although the Estimate provides for only one pair of Outer, and one pair of Inner Gates.

Q. 3. From your experience in founding Buildings of a Hydraulic nature, whether you conceive there to be any insuperable difficulties against the execution of the present design, and whether you conceive the objections offered by Major Schalh in his Appendix, Page 13, Paragraph 11, "Whereas Flood Gates not only requires the most scrupulous adjustment of their parts, but a degree of evenness of Floor, which can hardly be expected in a bed washed by a rapid stream during nine months of the year," are sufficient data to deter the Government from undertaking the construction of such works with the modification to the uninterrupted Current proposed to be introduced?

A. I have not had much experience that would enable me to give an opinion, even if I had been provided with the Plans and personal knowledge of the localities, all so necessary to be considered; I may however say generally, that I conceive it is very seldom that ground will be met with, where such a work may not be securely founded. With regard to Major Schalh's objection, I do not think it valid, or any reason why Government should not undertake the work.

Q. 4. Whether you consider Captain Prinsep's objections to Major Schalh's proposed Basin, between the Sleeper Dams at Sambazar and the River during the rainy months when the communication is closed, sufficiently obvious?

A. As far as I am able to judge from experience of the effects on a Channel closed in the end, leading from a River with a strong Current loaded with mud, I should think the effect would be to fill up the Basin to such a degree, as to make it useless as a place of refuge, except to the smallest Craft, and probably so much, that the action of Tides, low, compared with what they were when the deposit was formed, would not suffice to clear the Channel on the Sleeper Dams being removed, without previous expensive excavation under water.

Q. 5. Whether the system of Gates proposed by Captain Prinsep are sufficient, or whether you conceive that the additional expense of a third Gate, which would give the means of what is called penning or locking in and out, at any state of the Tide levels, would be warranted by the superior advantages and security it would offer?

A. I have before said, I do not conceive the Tide Gates alone sufficient, and I think that if it be worth while going to the expense of forming the Canal, the additional expense of the third Gate and its attendant extension, the Masonry should be authorised, as it would secure a communication at all times by locking, except when the River was lower than the Lake, and prevent the necessity of running the risk attending the shutting of simple Tide Gates with a strong Current.

Q. 6. Whether you consider 24 feet a sufficient breadth between the cheeks of the chamber or passage?

A. Probably too much, as I believe 2 feet beyond the extreme breadth of the Craft to be passed quite enough, at least for a Lock, and the less the breadth of the Gate, the less the risk of danger to them.

Q. 7. Whether the mode proposed of fastening back the Gate, to allow a passage of water during a part or a whole period of Tide, is practicable, and whether the closing them while a Tide is running through them, at the rate of 2 or 3 miles an hour, would be attended with any danger or difficulty from the press of water or fouling of the Floor?

A. There can be no difficulty in keeping the Gates open, when once they were so, and perhaps no great danger in shutting them with the Current through the Race or Channel as stated, but from its confined size, as compared with the Canal below it, the Current will increase most rapidly with the rise of the Tide, as it cannot pass the water fast enough to fill the Canal below, and keep an equal Current from the River level to that of the Lake, and I do not think a Native could be trusted or expected to know when they ought no longer to be open. If a Gate was long open, a Deposit might form requiring to be displaced, but if frequently worked, none of any consequence would be likely to occur.

Q. 8. Whether when the Gates are closed against a press of 10 or 12 feet of water, there would be any danger of bursting the Gates, in case *their* adjustment were not perfect, and leakage should happen beneath them or at the sides, and whether leakage is of any consideration when the economy of water is not an object, as in the present case?

A. I fancy this Question should have been "when the Gates are closed *with*, instead of *against* a press of 10 or 12 feet of water," as I cannot see how the case stated can occur. I look on the question to be No. 7 in an extreme degree, and then there is in my mind no doubts of the danger, if the Gates are let loose unsupported. If one door or leaf shuts before the other, I think under such a pressure it would be wrenched off its fastening; but think it practicable to shut them even in this case with safety, by a supporting Guy to the upper outer corner, eased off gradually from a well-manned capstan, until both doors meet in their true position, and mutually support each other. I do not see what harm leakage can do.

Q. 9. Whether in case of any apprehension of failure of an Outer Gate, the Sleeper Dams proposed would be sufficient to prevent any irruption of water during the greatest press, and whether the lowering of such Sleeper would be attended with either difficulty, delay, or danger?

A. If the timber of the Sleeper Dams are in scantling sufficient to support the extreme pressure, there can be no doubt of their answering the purpose required, and if lowered in anticipation of a failure, before the Gates gave way, no difficulty would attend the operations beyond that of getting them into the Grooves. If to be lowered with a flowing Current, the greater the velocity the more difficulty there would be in sinking them; but it does not appear a difficulty which may not be fully provided for.

Q. 10. In constructing the foundations, whether you would give the preference to a floor of Timber, or to an inverted arch for the chamber of the passage, supposing the soil not unfavorable to such construction as stated, from the Borings made?

(Signed) J. N. JACKSON,
Secretary, Canal Committee.

A. I can hardly answer this without a section, shewing the foundation of the Pier in connection with the flooring of the Chamber, as proposed; but as far as I can judge, I would prefer a counter-arch for the Chamber, rather than a frame or flooring of Timber.

(Signed) JOHN COLVIN, Captain,
Superintendent of Canals, Dellee Territory.

(True Copies.)

(Signed) J. N. JACKSON,

Secretary, Canal Committee.

[Superintendent of Canals Report of Dredging Machinery and operations in the Channel of the Salt Water Lake.]

The operations in deepening the Channel at the Western end of the Salt Water Lake, and within the mouth of the Eastern Canal, have been attended with every success that could have been expected; the Navigation of this part of the Channel is already very sensibly facilitated. By an admeasurement of depths in July 1827 and July 1828, a gain is manifest in the shallow part where the machinery works of $1\frac{1}{2}$ feet to 2 feet, the length being 6,000 running feet.

A short distance of 300 feet, where the bed is of a harder clay, is the only part where the machinery has met with any difficulty in excavating its full daily quantity of six boat loads, equivalent to about 1,800 mds. or 50 tons. In working at this part, the sheet iron buckets and endless clam have suffered great dilapidation, and a constant monthly expense has been necessary to repair them, and supply the place of those rendered unserviceable.

The remaining part of the Channel requiring excavation, has a bed of soft clay and rubbish, which offers little or no resistance of consequence, and quickly yields to the machinery. It was indeed of so fluid a nature when the excavation first commenced, as to fill in from the sides whenever the bed was deepened by the Machinery, so that the depth shewn by measurement, compounded with the length and breadth over which the machinery has passed, will be an insufficient measure of the mud carried away.

The second Dredging Machine is now finished and at work. Its construction is upon the same principle as the first, and I have therefore thought it unnecessary to forward a Drawing. In constructing it, I have however applied many improvements, which were suggested by my experience of the three machines of this description which have now worked under my charge, and the present Machinery will, I hope, be found more perfect and satisfactory in every way.

With the additional aid of this second Machinery, I hope to be able to report in a most favorable manner of the state of the Lake Navigation, as far as depth of water goes, in my next year's report; till which period I defer any proposition relative to the construction of tracking paths and subsidiary objects of that nature.

New Canal between Ghoonamegee and Kantatullah, and thence to Bha-meenghatta, with Plate No. 5. E.

The Eastern mile of this Canal has been carried through a Country raised considerably above the Tide Levels, and requiring much additional excavation.

The first 3,000 feet, as seen in the section, although excavated to an average depth of 15 feet, yield no more than 8 to 10 feet of water, the level of the surface being 5 to 8 feet above High Water mark.

The following three thousand feet have been excavated to the average of 10 feet, but yield only 5 and 6 feet water. Across this part of the track of the Canal, extends another spit of sand, similar to those at Bhowaneepoor and Chaltabarya, the frequent occurrence of which in these Districts I have before remarked to the Committee, and the nature of which is such, as to preclude the possibility of the excavations being carried *in the first instance* beyond a certain depth, (generally 5 to 7 feet below High Water mark,) without an expense much greater than would be warranted by the advantages expected from the Canal.

Of this Canal I have only opened to the admission of the Tide 7000 feet, of which there are parts where the slope has been left in steps, from the Contractors failing to finish the dressing of the slope within their time. This is of little importance, and may easily be rectified.

Of the remaining portion between the Bund B. of the 7th Lot, and C., where the Canal enters the inundated Jungul Land, so much has been left unfinished by the failure and general distress of the Contractors, that I have not thought it proper to open any portion to the Tide, until the whole is complete.

With some exertion, I have here prevented any necessity for incurring great expense in lifting the water to finish the bottom after the rainy season, by finishing the section wherever the Excavations deserted by the Contractors' workmen had attained the depth of 8 or 9 feet to the full depth of 10 to 12 feet, which will be found sufficient for every purpose of the Canal.

I have so enclosed these unfinished Excavations, that nothing but rain water can enter them; and it is my intention to use them for the supply of fresh water during the approaching season's operations Westward, until the water in them falls to a level, which will allow me to finish those parts abandoned at the fifth and sixth foot.

From C. the line enters upon the Jungul, and I had first to clear and embank the portion from C. to D. against daily inundation by the Tide. The first 1,000 feet of this part was ready for Excavation in January, and a Contractor, who ultimately failed in excavating more than 528 feet to the depth of 3 to 6 feet, was established upon it in February.

The remaining portion to D. was cleared and embanked; but as the difficulty was greater, I commenced in March to excavate this portion under my own eye, with Coolies receiving daily pay, and subject to a daily measurement of work. I had not been able to excavate more than 300 Chowkas of this line in May, when I found myself obliged to bring all my disposable hands to assist the Contractors of Nos. 8, 9, 10, 11, 12, and prevent the Excavations from being left at a dangerous depth, or one that it would be difficult or expensive to lay dry in a following season.

In short, of the 17,500 feet between A. and D., 13,500 only have been commenced upon, 7,000 opened to the Tide, the remaining 6,500 only about two-thirds finished. The total number of Chowkas completed being 12,000, there will remain 9,500 to excavate next year up to D, besides the Canal of one mile, between E. and F. to Bahmeenghatta.

The average inclusive rate per Chowka* has differed very little from that of last year, and the rate per mile of Canal will therefore still fall short of 10,000 Rupees.

*This year l : 12:5
Last year l : 12:4½

The amount Balance left outstanding, and which I am now rapidly collecting, is Rs. 3,157 : 6 : 4; by no means large in proportion to the outlay of Rs. 21,926, more especially when the difficulties of the season are considered.

State of the Chaltaberea Canal and the Works executed in connection with it during the season.

The expenses incurred in assisting the free passage of the Tide through this Canal, by deepening and enlarging the Bhungur Nullah into which it leads, have amounted to 2,550 Rs.

The Excavations have been confined to the Channel below the points B. and A. of the Plate,† bearing date August 1827, which also accompanies this Report.

† No. 2. B.

It was also my intention, during the present year, to have deepened the 7,000 feet of Old Nullah, between the Western end of the Chaltabarya Canal and the New Goonamegee Canal, and for that purpose, I had closed it from the Tide in February and March, and laid a great portion of it dry. It was, however, so late before the soft mud which forms the

‡ Costing 620:7:9.

bed had dried sufficiently, that I had not been able in May to finish more than 1,000 feet,‡ when I found myself under the necessity of otherwise employing all my daily Coolies; 6,000 feet therefore remain for the approaching season.

The effects of what has been done to enlarge the mouth of this Canal are already apparent. I attach a Schedule of the phenomena of Tides, shewing their slopes in November, March, and July. The velocity and power of the Tide, which bears a certain relation to the slope of its surface, is evidently gaining progress within the point B., or mouth of the Canal. In November, when there was much obstruction between A. and B., the greatest slope during the Ebb is found between those points, while in the Canal the water remained comparatively still, and of even level. In March, when those obstructions were removed, and a greater freedom afforded to the Tide in its passage from B. to A., and even farther East, the greatest slope is found to have retired within the Canal to the portion between the 6th Lot and B. In July again, when the passage of Tide was still more free, and the effect of the head of water kept up in the old Western Nullah was brought to play, the greatest slope had divided itself nearly equally over the whole length of Canal under this form. I observe the softer part of the banks to suffer a little, and I may hope gradually to discover an action upon the sandy bed.

The accompanying Schedule of Tide will shew the Committee, that a Canal under the circumstances of the Chaltabarya Canal, can never require the great depth of a Canal more immediately in contact with the larger Creeks, in which the rise and fall of Tide amounts generally to 7 and 10 feet. With this view, I have assumed as a requisite depth for the Bahmeenghatta Canal, 2 feet less than would be otherwise necessary, if therefore the lapse of another season shews it to be absolutely necessary to go to the expense of excavating those parts of the Chaltabarya, and 3,000 feet of Bahmeenghatta Canal, where the sand has prevented a sufficiency of depth, (which will I believe be easy now that the sand of the bed has had time to admix with the clayey particles carried along by a gentle Tide,) an additional 3 feet average will be amply sufficient to answer every purpose of Navigation.

No. 102. *b.*

Bhowancepoor Canal.

From a knowledge of the local difficulties of this work, I commenced and have carried it on entirely by daily workmen in preference to contract. The season has been unusually unfavorable, and I have not been able to complete more than 3,700 feet of Canal, the whole length required being 10,000.

Upon advances of 2,500 Coolies, I found myself unable to collect and retain upon the work a greater number than 9 and 700, which perhaps may be within one-third of what I can ever reckon upon collecting in such an unfavorable spot. The sickness, and consequent panic that prevailed in March, reduced this number to 300, which was never exceeded for the remainder of the season.

The method of conducting this Canal has, however, secured me against any loss from this failure in the number of workmen, and I have the satisfaction of knowing, that the whole Section, 3,700 feet, opened, has been finished to the full depth of 12 feet.

The Contingent and Establishment Charges upon this Canal are unusually heavy, on account of the nature of the work. The expense of ridding the Section of large roots alone has amounted to Rs. 1,027:14:0; that of supplying fresh water to the workmen Rs. 448:12:0. I have however every expectation that the rate per mile, even under these great disadvantages, will not reach 15,000 Rupees.

I have no farther remarks to offer in addition to those of last year, upon the track over which this Canal has to proceed. The line there marked out A, B, C, D, E, F, has been strictly followed, and the Excavations have reached B., and passed within the Northern edge of the spit of sand without any diminution of depth.

I hope to be able to complete the Canal during the approaching year.

Vide Plate C. or
No. 3.

No. 102. c.

Kullooardam, and Works connected with the Canal at Hoseinabad.

The Committee have already before them my Letter 112,* giving an account of the causes which baffled my endeavors at stopping the head of the Kullooar Creek, upon which the orders of the Governor General in Council have already been passed. A few observations will not be thought misplaced in this my final Report upon the season's operations.

* 3rd May, 1828.

A disappointment of the kind in a work which has frequently been practised with success by the Native Zemeendars, to whose usual method of construction I added much of a more substantial description than is usually applied by them, cannot but weigh heavily on my own mind, and may tend to diminish the confidence of my employers in my zeal and exertions. The Committee will, however, take into consideration the local difficulties of the place, as well as the difficulties of the seasons. They will also acknowledge that the large Zemeendar possesses means of collecting labourers, and possesses an influence to ensure their attendance upon the work, which no European or stranger in the District, without the aid of magisterial powers, can ever bring into action. The spot upon which the work was carried on, being the same upon which my predecessor's labors upon the Balleygunge Canal proved so disastrous, I took more than usual precautions for the comfort and health of the great quantities of people whom I expected to be able to collect, to protect myself against the same fearful desertion which a similar panic had created in 1823-24. The line of road of $1\frac{1}{2}$ miles through Jungul leading to the work, was placed in good repair, and cleared to prevent any imaginary danger from tigers from seizing them in their path, extensive sheds were prepared for their accommodation on the banks of the Eshamuttee, and in the neighbourhood of the only tanks within some miles. A large establishment of Boats was kept up for providing the people, when at work in the Jungul, with fresh water. In short, I spared no precaution I could think of, and incurred much larger contingent expenses than I had contemplated in my Estimates.

The great dread of the Jungul which pervades the Districts at all removed from its immediate neighbourhood, and perhaps the memory of what they had suffered in the year 1823-1824, when engaged upon the Bayleygunge Canal, protracted the period when I had sufficient numbers collected to commence the Dam to a time when the Tide had gained a greater force than I could have wished to contend with; much unlooked-for expense was thus occasioned, and the uncertainty of the undertaking proportionally augmented. The rise and fall of Tides between October and the end of February never exceeds 7 feet extreme; from this period the encrease; and in April and May the extreme rise and fall reaches 11 feet. From the marginal note detailed, the general strata in which the Excavations were carried on, it will be seen how little consistent soil fitted for the purpose was procurable, and how much extra digging was necessary. The practice followed was not to reject the upper 5 feet of soil, but either to protect it from corrosion by the rapid Tide with the heavier clays from underneath, or when the dykes were more

Surface.	Soft Mud.
0 6 ..	Rotten vegetable matter and roots spongy and light.
1st.	
3 6 ..	Stiff clay, wet
5 0 ..	Clay, compact.
8 6 ..	Peat and vegetable.
9 0 ..	Remain blue clays, with sand not very consistent.

the rapid Tide with the heavier clays from underneath, or when the dykes were more

advanced in the stream, to enclose the whole of the lighter soils with a proportion of the heavier in the large baskets (doles) of 4 feet height and 3 feet diameter, which I had made for the purpose, over which the Tide might break without danger of carrying any portion away.

There are two points upon which I believe I might have obtained greater certainty, if I had followed my own judgment, in preference to the system which the Natives of the District usually adopt. The 1st. If I had from the first substituted European built condemned Craft (Sloops) in preference to the large Native Craft, 2 to 4,000 mds., which proved too slight. The next. If the pile driver had been more powerful, so as to have bottomed the piles in ten or 12 feet of soil, instead of 6 or 8, beyond which my ram failed in driving them.

In March, when I had collected the greatest number of hands, the work proceeded rapidly, and although the soil used was of so bad a quality, the rows of piling, the sunken boats and facinage, the defence of doles built like masonry, and the great quantity of mud thrown in daily, prevented the spreading force from being of so serious consequence as it proved, when in April desertion of the Coolies so reduced the quantity of mud built in daily, as to allow the water to mix more with the new earth thrown in, and prevent the dyke from consolidating properly during its progress by its own weight.

Although I have little doubt in my own mind that the work would have succeeded, even so late in the season as April, but for the loss of hands created by the dread of the Cholera, which raged so fearfully, I cannot say, that in a second attempt I should be willing to pursue an exactly similar mode of construction. The mode adopted offered economy, but was precarious. Other methods might easily be pointed out, attended with much greater expense doubtless, but which would offer infinitely more certainty.

The expense attending the work as per Abstract, has much exceeded the sum stated of 12,000 Rs. From the total amount in my accounts, rendered under the head *Kullooar Dam and other works connected with Hoseinabad*, is to be deducted an amount of 1,606 : 6 : 0 Rs. expended extra for excavating a Cut of 700 feet across the neck of land between the Dansar Kahl and mouth of Baylygunge Canal, the soil of which was carried at great expense to the Dam at the distance of 3 to 800 feet ; also a sum of Rs. 200 : 7 : 9 for some additional excavations in the Baylygunge Canal, during May ; also a charge of 632 : 14 : 4 Rs. for excavating the mouth of the Hoseinabad Canal to the depth of 5 feet below H. W. M. ; the season having been too far advanced when I commenced it in June, to excavate deeper, it will require some additional labor in the approaching season, unless the strength of the Current through it from the Eshamuttee during the Freshes render this unnecessary.

Eastern Canal Roads and other Miscellaneous Works, executed in the season ; not immediately connected with the Scheme of Canals.

In executing the repairs to the Roads on the two banks of the Eastern Canal, as authorized by the Canal Committee, 30th November 1827, I deviated from the exact proposition and estimate for that portion immediately before the Wood Bazar, in a manner which from the great advantages it has afforded to the firewood trade, I hope will meet the approbation of Government.

It was my intention to have dismantled a certain number of the huts of this Bazar, the ground of which is the property of Government, in order to give an additional breadth to the Road. Finding that there would be great delay and some difficulty in carrying this into effect, I examined the nature of the soil which had been deposited before it by the Main Drain of Calcutta, by which the Craft employed in the firewood trade had been prevented coming within 600 feet of the end. Its nature was more favorable than I could have expected, and

I have now built a new slope, giving additional breadth to this part of the Road, from a Channel excavated to the depth of 4 feet, by which the Craft may come to the very Western extremity of the Canal.

The remaining repairs have been executed as proposed. The 2,500 feet of Khoa before the different Bazars is found of the greatest advantage; for notwithstanding the attention paid to the slope and drainage of the Road, the soil is of much unfavorable quality, and the passage of wheeled carriages so incessant even during rain, that many parts are very deep, and are likely to be much cut up before the dry season.

There are also some parts where the adjoining proprietors have prevented the Drainage of the Road, and it appears indispensable to construct some arched Drains across the Road in many parts, where there is no other way of leading off the water but into the Canal.

In the month of October last, I had the honor to submit some remarks upon the Bed and Tides of Tolly's Nullah, and I received the orders of the Committee to try an experimental Dam, which I by no means offered as sufficient to remedy the great defects of that Navigation, but as likely to afford some little relief in the draught of water left by the Ebb Tide.

The great concourse of boats in this Nullah, and constant passage to and fro made it dangerous to hazard an experiment of the kind at the Allypore Bridge, I however constructed four Gates or Shutters, and erected in the month of January two into a Dam at Gurriahaut, and two into a second Dam at a distance of two miles East of Gurrya.

The Gates swung upon their pivots to every Tide, and answered every purpose in point of construction.

From the moment of their being fixed, I have kept a daily register of the Tides in the two places; but from not having a registry to the same nicety for any former year, I cannot ascertain, with any great precision, the effect created by these Shutter Dams.

I am not sensible of having made any greater difference than 3 or 4 inches, in the lowest state of the Tide by these Dams; nor could I expect, without a corresponding Dam at Allypore, that any great inequality of action could have been created. The immense concourse of boats in this Channel have also great power in diminishing the effect of any such contrivance. I could, however, sensibly perceive an afflux at each Dam while closed against the Ebb, and also that the Ebb Tide fell to its lowest level much more gradually than after I had removed the Dams in April.

During the Neap Tides of the five dry months of the present year, the draught of water left in the Nullah at Gurria was 2 to $1\frac{1}{2}$ feet; three miles of the Canal in the neighbourhood of Rasypugla being left quite dry, or with only 6 inches water. The bed has not filled up, and this circumstance is an illustration of my remarks of October last.

The annual variation of Tide at Gurrya appears by my observations to have increased from 8 feet 5 inches to 9 feet 4 inches, and may be expected to increase still more by the removal of more obstructions.

The general result of the experiment has, I fear, not been such as to warrant its more extended application in this Nullah, where there are so many causes to diminish its effect, and many objections to any multiplication of the present obstructions to the Navigation.

The expense has been very close upon the Estimated rate of 200 Rupees per Dam, the amount being 469: 2: 4, inclusive of contingencies and establishment. The Gates and Frame Work remain in store, in perfect order, for any purpose to which they may be thought applicable hereafter.

Scheme for the Muffussil operations during the approaching season 1828-29.

In preparing the annexed Scheme, which will otherwise appear on too limited a scale to engage my attention when compared with the expense of the whole Canal Establish-

No. 107.

Answers by Captain W. N. FORBES, (Engineers,) to the same Queries to which Answers were requested from Captain JOHN COLVIN, Superintendent of Canals, Delhi Territory. See page 93.

A. 1. I am of opinion that without Dams, Tide Gates, or Locks, the Current entering or retiring through the Canal may, by various means, be made so to modify and regulate itself, as to admit of safe and convenient Navigation at all times of the Tide, and at all seasons of the year.

A. 2. I conceive that it would be beneficial and practicable so to construct the Canal, as to dispense with Tide Gates.

A. 3. Were the Plan involving a necessity for Tide Gates adopted, all difficulties of construction could be overcome.

A. 4. I consider Captain Prinsep's objections to Major Schalch's Basin perfectly well founded; further, that by the Plan proposed by Captain Prinsep, the Navigation may very safely be maintained during particular states of the Tide at all seasons of the year.

A. 5. With Tide Gates, I conceive that the additional expense of a third Gate, affording the means of Locking in or out at all states of the Tide, would be warranted.

A. 6. I believe that 24 feet betwixt the cheeks of the Gate passage, would be sufficient breadth.

A. 7. The Current might be managed, so as to prevent fouling, or difficulty in opening or shutting the Gates.

A. 8. Supposing the Gates well constructed, there will be no danger of their bursting; according to the views the data furnished have led me to, I conceive any probable leakage will be advantageous.

A. 9. With reference to the repairs of the Gates and other considerations, the Sleeper Dams might conveniently be placed exterior to the Gates.

A. 10. The preference ought decidedly to be given to an inverted Arch with a considerable versed Sine.

October 24th, 1828.

(Signed)

W. N. FORBES,

Captain, Engineers.

CANAL COMMITTEE'S OFFICE,

CALCUTTA,

7th April, 1828.

(A true Copy,)

(Signed)

J. N. JACKSON.

No. 108.

Answers by Captain W. R. FITZGERALD, (Engineers,) to the same Queries to which Answers were requested from Captain JOHN COLVIN, Superintendent of Canals, Delhi Territory. See page 93.

DUPLICATE.

A. 1. Of the two Plans proposed, I would give the preference to the system of Tide Gates.

A. 2. I consider the system of Tide Gates to be the most efficient method of preserving the Navigation of the Canal, under the circumstances stated.

A. 3. It appears to me that the objections mentioned by Major Schalh are insufficient; the construction of the Locks themselves obviates all danger to be apprehended from the rapidity of the stream.

A. 4. I think the objections are just, but I am of opinion that practically the deposit in the Basin of Shelter would be removed upon the Cutting of the Dam, though probably to the injury of the Canal.

A. 5. One Gate I should imagine would be sufficient for all the purposes of security. The construction of an additional one seems to me, to be a matter of convenience, and to depend on the probable amount of the Revenue derivable from the Canal.

A. 6. Yes.

A. 7. I am of opinion that it is. That the danger arising from the press of water, &c. can be overcome.

A. 8. I should think that no danger need be apprehended, and as a bed of Masonry is to be constructed across the passage, leakage cannot be of any consequence.

A. 9. The proposed Plan of the Sleeper Dams appears to me to be sufficient.

A. 10. An inverted Arch would I think be the most durable, more particularly if Stone were used in the construction.

(Signed) W. R. FITZGERALD,
Captain, Engineers.

CANAL COMMITTEE'S OFFICE, (A true Copy.)
CALCUTTA (Signed) J. N. JACKSON.
7th of February, 1828.

No. 109.

Answers by J. KYD, Esq., to the same Queries to which Answers were requested from Capt. JOHN COLVIN, Superintendent of Canals, Delhi Territory. See page 93.

A. 1. Should the line of communication be fixed or confined, so that the difference of level cannot otherwise be surmounted than by Gates, I agree entirely in the propriety of Captain Prinsep's Plan ; but if it be possible to lengthen the line of communication, in that case, a lengthened winding course, so as to reduce the fall of Water, similar to what nature observes in Rivers, will, I think, be a preferable mode, being simpler, and requiring no Locks or Gates whatever.

A. 2. Answered by the first Answer.

A. 3. No difficulty whatever.

A. 4. Captain Prinsep's objections to Major Schalch's proposed Basin are sufficiently obvious.

A. 5. I should prefer the 3rd, or rather the 3rd Set, for there ought to be 2 Gates, so as to have the advantage of Penning or Locking the Water in.

A. 6. Sufficient.

A. 7. Quite practicable. No difficulty or danger.

A. 8. No danger of bursting. Moderate leakage of no consequence.

A. 9. The Sleeper Dam would be quite sufficient, but its position ought to be outside of the Gates. No difficulty or danger.

A. 10. An inverted arch.

(Signed) J. KYD,
Master Builder.

No. 110.

Answers by Major JOSEPH TAYLOR, to the same Queries to which Answers were requested from Captain JOHN COLVIN, Superintendent of Canals Delhi Territory. See page 93.

MY DEAR JACKSON,

I did not keep a copy of my reply to the Queries proposed relating to the Canal, but I very well recollect, that I coincided in opinion with Captain T. Prinsep.

Yours very sincerely,

JOSEPH TAYLOR.

27th December, 1828.

No. 111.

(Copy.)

TO H. MACKENZIE, ESQ.

Secretary to Government, Territorial Department.

SIR,

I have now the honor, by desire of the Canal Committee, in reply to Mr. Offg. Secretary Prinsep's Letter, under date the 6th of December 1827, but more particularly

* Major Taylor,
 Captain Colvin,
 " Forbes,
 " Fitzgerald, and
 Mr. Kyd.

to its 3rd Paragraph, to submit in original the Queries given to the several Officers named in the margin,* together with their Replies.

In the face of the unanimous opinion of so many persons of acknowledged talent as Engineers, and which coincides so closely in all points of material importance with the views and opinions of Captain Prinsep, the Committee feel it unnecessary to do more than submit the whole of the Documents, for the consideration and orders of the Right Honorable the Governor General in Council.

When the Original Papers herewith forwarded shall be no longer required, the Committee request they may be returned to their Office for record.

I have, &c.

CANAL COMMITTEE'S OFFICE,
 CALCUTTA,
 3rd November, 1828.

(Signed) J. N. JACKSON,
Secretary to the Committee.

No. 112.

To W. MONEY,
 J. MASTER,
 C. R. BARWELL, } ESQRS.

Canal Committee.

Territorial Department, Miscellaneous Revenue.

GENTLEMEN,

I am directed by the Governor General in Council, to acknowledge the receipt of your Secretary's Letter, dated the 3d November last, with its enclosures, and to inform you, that His Lordship in Council approving generally the Plan proposed by Captain Prinsep, desires that that Officer may be directed to take the necessary measures for carrying it into effect.

2nd. You will be pleased to ascertain and report the amount of advances required by Captain Prinsep.

3rd. The original Papers received with your Secretary's Letter are herewith returned, copies having been kept for record.

I have, &c.

COUNCIL CHAMBER,
 The 6th January, 1829.

(Signed) HOLT MACKENZIE,
Secretary to the Government.

No. 128.

No. 260.

To MAJOR J. N. JACKSON,

Member and Officiating Secretary of the Canal Committee.

SIR,

I have the honor to submit for the information and scrutiny of the Canal Committee, the yearly abstracts of expenditure in the Department of Canals for 1829-30, together with a Report of the progress of the several works under my charge, and a sketch of what remains to be effected during the approaching season.

2. The Committee are well aware of the painful circumstances under which the Governor General in Council was pleased to entrust to myself, the completion of the undertaking partly planned, and so long conducted by my brother, the late Captain Prinsep.

3. It has been my object, and indeed my pride, to follow implicitly his designs and measures, and to act exactly as I conceive he would have done, had his life been spared to accomplish and complete them.

4. His views of the past operations and remaining objects of the Canal works are before the Committee in the fullest detail; they have met the Committee's approbation, as well as the final sanction of the Government. They have formed my guide; leaving me few difficulties to cope with in their execution, and these few have been lightened by the trained experience of the establishment transferred to my orders, and by the extreme exactitude of all the accounts and records attached to the Office.

5. I beg to refer the Committee rather to my brother's reports, than to my own for the premises upon which to ground their directions for the ensuing year's operations, as I feel myself as yet too inexperienced to dwell with conviction upon my own opinions; besides that, ill health and other official avocations have prevented my devoting my whole attention to the subject of the Canals: I trust, however, that the Committee will have no cause for dissatisfaction in the general progress of the works.

6. I beg leave incidentally to acquaint the Committee, with the publication of my late brother's Map of the Soondurbuns, which I hope will prove useful in promoting the intercourse of Eastern traffic through the Canals. I was induced to publish this Map, and a smaller Chart of the Delta Navigation, in pursuance of my brother's intentions, and from his own corrected Manuscripts, because I found a general wish for an authentic Map prevailed, and none of those which I heard of, seemed so well calculated to answer the purpose as the MS. in my possession. The Government have been put to no expense in its publication; and the profits have been devoted, according to my brother's wish, to the artist, (Mr. Tassin,) who executed the lithography of his Charts of the Ganges.

I have the honor to be,

Sir,

Your most obedient humble servant,

JAMES PRINSEP,

Superintendent of Canals.

OFFICE OF SUPERINTENDENT OF CANALS,

CALCUTTA.

15th September, 1830.

Report on Canal Operations 1829-30, 15th September 1830.

In the Report submitted to the Canal Committee in September 1829, the several works projected for the ensuing season were classified under two heads; 1. Mofussil operations, and 2. Circular Canal; under the former head were included—

1. The Dredging operations in the Salt Water Lake and Eastern Canal,
estimated at Rs. 7,200 0 0
2. The Bahmunghatta Canal, 2,800 running feet, 8,000 0 0
3. The Chytul Canal, one mile Cut, 10,000 0 0
4. Deepening the Bayleygunj Canal, above 5 feet, 8,000 0 0

Making a total expenditure of Sa. Rs. 33,200 0 0

Under the Head of Circular Canal, were specified (without estimate) for the year's operations, to be covered by an assignment of Rs. 1,00,000—

1. Three Suspension Bridges of the Bytukkhana, Maniktola, and Narkuldanga Roads.
2. Brick-making, namely, 50 lakhs to be burnt.
3. The Double Flood Gates at Chitpoor, at 60,000 Rs.
4. The continuation of the excavations: the whole length of which being 20,000 feet, whereof 10,500 were Cut in the past season, leaves about as much more to complete the work.

2. The Operations of the season were prosecuted in accordance with this Plan, and although impeded by the lamented loss of the Superintendent, and the interruptions of a peculiarly wet season, the greater portion of the work laid out has been accomplished.

3. The accompanying Abstract of the year's expenditure shews, that it has not materially deviated from the above Estimate; for comparison's sake, I will recapitulate the several items, and afterwards proceed to explain the circumstances of each.

- | | |
|--|--------------------|
| 1. Dredging Operations, | Rs. 6,841 4 2½ |
| 2. Bhamunghata Canal, 4,263 running feet, | 8,631 5 6 |
| 3. Bhojdigee Canal, (finishing 557 choukas,) | 1,580 14 2½ |
| 4. Chytul Canal, (excavated ⅔rd depth,) | 5,015 10 11½ |
| 5. Bayleygunj Canal deepened, | 8,489 11 10¾ |
| 6. Balya Ghat Road Drains, | 44 15 2 |

Making a total expenditure of Sa. Rs. 30,603 13 11¼

4. Upon the Circular Canal have been expended, as per Appendix B.

- | | |
|---|-----------------------|
| 1. Excavations of 6083 running feet, | Rs. 33,735 12 11½ |
| 2. Masonry and Contingencies of Bridges, | 20,368 2 4 |

Making a total of Sa. Rs. 54,103 15 3½

5. I shall now proceed to offer a few remarks upon the several works, in the order above enumerated.

I. Dredging Boats.

6. During the whole of the year, the Dredgers have been at work upon the Eastern Canal, ranging from the Lake to the Bund East of Kood Ghat, up to which the Canal had been deepened by hand in the year 1827.

7. To judge of the effect actually produced by the continued action of the two Boats, I had soundings taken along the 5,000 feet of Canal operated upon during the present and former years, (Appendix D,) and find therefrom, that the general bed of the Canal has been deepened on an average two feet and six inches since the 26th December 1827. I am unable to say how much of this is due to the last season's work, but assuming as the maximum one-half, or 1 foot and 3 inches, it follows that the cost of Dredging 5,000 feet to that depth has amounted to 6,800 Rupees, or nearly one Rupee per running foot, for one foot of depth. The expense of bunding and deepening the Western half of the same Canal to a clear depth of 4 feet, was about 5,000 Rupees per 6,000 feet run; or less than one-fourth of the foregoing. As the prime cost of the Engines and Boats is not included in this comparison, the disadvantage of the employment of Machinery must be acknowledged to be still greater than I have estimated it to be: in fact, the wear and tear of the Boats and Iron work, or rather the continual patching of the chains and buckets, and the caulking of the Boats, which but partially represent the wear and tear, cost annually as much as the labour and establishment. At the present moment, the Machinery of the old Boat* is hardly in a servicable condition, and the Boats are not trustworthy: one of them indeed fell to pieces in July last, and I had some difficulty in extricating the Dredging Frame, which sank with it, and in procuring a Boat of the same size to take its place; this accident, and the price of the new Boat greatly enhance the month's expenses.

8. From these considerations, the Committee will be prepared to find me object to the employment of Dredging Machinery, where manual labour can be more directly applied: perhaps in the present instance as sufficient depth has been attained for the purposes of Navigation by the Boats of the Lake, it is not worth while *now* to resort to the method of Bunding, and as long as the Boats last, they may remain engaged as at present. I should beg, however, to recommend that the Old Boat, when it ceases to be repairable without disproportionate expense, should be taken to pieces, and the parts available be kept to repair the New Boat. The latter being of stronger construction, will always prove useful, and indeed there are many cases in which such an apparatus is indispensable, as in digging away the under water-bases of Bunds, and clearing parts of the Lake Channel to which Bunding would be inapplicable.

9. I have endeavoured to reduce the establishment and the contingent of the Dred-

Former Estim.	Present Estim.	gers, (as per margin,) and hope to effect further saving by
Chuprassee, .. 1	.. 1	abolishing the Smith's Godown, (for which rent is paid,) and
Classees, .. 4	.. 2	bringing this department under my own eye at the New Mint,
Manjee .. 2	.. 2	when my office shall be removed thither.
Do. Mud Bts. 8	.. 8	
Dandeas, .. 34	.. 28	
Coolies, .. 45	.. 38	
Men 94	79	

10. As it is impossible to say how long the Old Dredger may continue capable of doing work, it will be safer to include in my scheme for the ensuing year, the same dis-

bursement for Dredging as was sanctioned last year, namely 600 Rupees per month.

II. *Bahmunghata Canal.*

11. The Report of 1829 notices that a small portion (about 500 Choukas) of the Cut from Kantatulla to Ghoonamegee remained unfinished. This portion was completed at the time of my first visit to the Mofussil Canals in March, when I ordered the Bunds to be Cut away. I found it necessary to send a couple of the Mud Boats to assist in drawing the Piles

* The new Boat too, which was working near the first Lake Chokies was obliged to be brought into the Eastern Canal ten months ago, as the earth in the former place was found to be too hard for the buckets, which either scraped the surface only, or were torn to pieces by the resistance.

at the mouth of this Canal, and there still remains some of the Bund, causing a fall of water when the Tide runs out : this may be removed in the winter by one of the Dredgers. The expense incurred on this (the Bhojdiggee Canal) has amounted to Rs. 1,580 : 14 : 2½. This Cut has been very successful, as it carries the strong Tide of the Kantatulla Khal through it, and thence upwards by the North branch of the Doodhbeebie Khal ; so that there is little danger of its becoming filled up.

12. Of the Bahmunghatta Canal, properly so called, 3,700 feet were excavated and opened in the year 1828-9. Before the 1st March 1830, 1,478 feet more were ready for measurement ; the remaining 860 feet were completed to the full depth of 12 feet, in April ; and the last 2,000 feet, (following the course of a small Nulla, which had to be widened and deepened,) was reported finished ere the rains set in. Illness prevented my then visiting the works, but I had taken the measurements up to the 15th May.

13. All that remains to be done in the Bahmunghata Canal, is to cut away the residue of six Bunds, the expense of which, if done as before proposed, is already provided for in the Dredging abstract.

14. The expense incurred has a little exceeded the Estimate, this is chiefly to be attributed to the heavy rains of March, April, and May, which continually flooded the works, injured the Bunds, and increased the expense of hutting the labourers.

15. The Tides of the Kantatulla and Tarda Khals are nearly simultaneous, so that they meet in the New Canal ; but as the numerous outlets to the Eastern half of the Lake, which were bunded during the excavation, can easily be re-opened, should the aspect of the Canal render a stronger current advisable, (a point I hope soon to ascertain by inspection,) I do not think it expedient to come before the Committee with a proposition to throw a Bund across the Kantatulla, as had at one time been suggested by the late Superintendent.

III. *Chytul Canal.*

16. This short Cut was recommended by the late Superintendent as a substitute for a longer route through very unfavorable country proposed by Captain Schalch : my brother himself, however*, qualifies his recommendation by reminding the Committee, that "a route still exists by the Aktratulla and Bairmaree Khals to connect the Bhuwaneepoor Canal with Busera." The Cut was sanctioned by the Committee, and nearly two-thirds were completed before I received charge. The direction taken passed through a Jheel, to the Eastward of which was a sand ridge of considerable width, rising 3 feet above the neighbouring levels. It was intended to excavate here to the depth of 14 feet, but the water rose so rapidly through the sand, while at the same time from the weather, and from a Bund having given way, the rest of the Canal was under water, that I imagined the expense of getting the bed dry with so little of the season before me, would be greater than was warrantable ; I therefore directed the Bunds to be partially cut away in April, leaving the average depth below the bed of the Jheel 6 feet. In May I found the Cut very servicable, with a depth of 7½ feet at high water, and a strong Flood Current setting through it from the Choumoooh to the Aktratulla Khal, and vice versâ, with the ebb. Notwithstanding, therefore, the disadvantage of the sandy spit, the shortness of the Chytul Canal ensures a rapidity of Tide which will keep it open, and even tend to cut it deeper than at present ; while from its passing through cultivated country, it will always be much frequented by Boats, the largest of which will find ample water to enter it at the top of the Flood, and it is useless to pass it at any other time, because the Choumoooh Khal must convey the craft up to the Canal with a rising Tide, and the Aktratulla must be descended as far as the Cheetpoor Khal and Bhuwaneepoor Canal, with the Ebb.

* Report 1829.

17. At any rate, the choice of passing by the other route remains ; I see no reason therefore to recommend to the Committee that the Chytul works should be resumed at present, excepting so far as is necessary to clear the passage from Bunds, and throw it more completely open to the Currents, to and fro, of the Tide.

18. The disbursement upon this work was little more than half the estimated amount ; it is as well, however, that the balance should be held as disposable upon its completion, should it hereafter be deemed expedient to deepen its section, according to the original design.

IV. *Bayleygunj Canal.*

19. It was partly with a view of concentrating as many hands as possible upon this work, that I abandoned the Chytul Canal in April. It seemed to me very essential that the whole line should be completed in one season, as otherwise the higher level of a part of the bed might be expected to spread its contents over that newly excavated, and thus render it nearly as bad as before, for the earth of the Sunderbun alluvium is of so very soft and yielding a nature, that when moistened with water, it soon loses all traces of the spade, and acquires a level like treacle, or pitch. Unfortunately, however, the season was unpropitious, hardly once allowing the surface of the ground to be thoroughly dried before the cutting commenced : indeed, it was in many places rather *ladled out* than *dug*, and the labourers complained that it filled in from below as fast as they removed it. At one spot, for a length of 250 feet, where the excavation had been completed to the intended depth of 6 feet below the old bed, a sudden sliding in of the Banks occurred, which raised the bed $3\frac{1}{2}$ feet, after the water had been admitted upon it, and consequently when no remedy could be applied. Adjoining to the place just described, the section traversed a stratum of sand of 600 feet width. This again was excavated with some exertion to the depth of 4 feet, when the oozing of sand from below seemed to set at defiance all further endeavours. The rest of the Bayleygunj Canal was of a more promising character, and it maintained the full depth required ; namely, 10 feet below the surface, or high water level of the country.

20. There are then 875 feet run of this Canal still unexecuted to the requisite depth by from 3 to 4 feet : still I feel some hesitation in placing them in my schedule of works for the ensuing season, as I am by no means confident of the practicability of deepening such a soil in a permanent manner. It will be in the memory of the Committee, that this Canal has already been once filled in since it was executed by Captain Schalch in 1824-5, and I am inclined to attribute this gradual effect as much to the oozing upwards of the soft sandy matter of the soil, as to the operation of silting or deposition of matter held in suspension by the water, which passes through with less velocity, on account of the simultaneous Tides of the Kulloa Gung and the Bunbeebee Khal.

21. In the ensuing season, therefore, unless it is the opinion of the Committee that the whole line should be made of uniform depth if in any way practicable, I propose confining my operations at Bayleygunj to the removal of the Bunds ; watching the progress of the processes of deterioration in this Canal, in order if possible, to suggest some remedy. I would here beg leave to remark, that the Plan of Damming up the Kulloah Gung appears to have been very judicious in theory ; as from the large body of water in the Ishamuttee, as well as from its connection with the Ganges, there is a powerful Ebb Current passing hence through the Hoseinabad Canal, which would have served to keep both that and the Bayleygunj Canal open, had the Kulloar Dam been experimentally successful. It is the failure of this bold measure under the skilful and indefatigable exertions of my predecessor, which, together with the large outlay, prevents my recommending a renewal of the attempt.

22. Experience has, however, long since proved, that Captain Schaleh's scheme of a permanent line of Canal crossing the upper ramifications of numerous Tideways cannot be maintained in such a soil as that of the Soondurbuns, with sufficient depth for the Navigation of large Boats; while ample evidence has been afforded, that it must soon become a series of Tide Channels passable only at high water. As long, however, as the apex (if I may so term it) of each section is situated at such a distance from the last as to occupy the period of one Tide nearly in the passage of a Boat from one to the other, there will be no great disadvantage in such a system. The Tide Navigation of the line of Canals, as far as the Eeshamuttee or Juboona River, may be disposed as follows:—

	Miles.	Hours.
<i>First Ebb.</i> —Start from the Eastern Canal through the Lake Channel and pass the <i>Bhamunghatta Cut</i> , before the Tide has fallen too low, to <i>Kantatulla</i> ,*	7	2½
Wait for change of Tide,	0	3
<i>First Flood.</i> —Enter the <i>Bhojdiggee Canal</i> , and reach <i>Bhungar Hat</i> by the High Water of ditto.	6	2½
Wait,	0	3
<i>Second Ebb.</i> —Moving on with the slack water of the <i>Chultareea Cut</i> , run down the <i>Beharee</i> and <i>Choumooh</i> Khals to the <i>Mundaree</i> ; and if able to stem the Current, row up to the	12	11
<i>Second Flood.</i> — <i>Chytul</i> , cultivated land to pass the night,		One day
<i>Third Ebb.</i> —At high water pass the <i>Chytul Canal</i> , and descend the <i>Akratulla</i> to <i>Cheetpoor Khal Tirmuhanee</i> ,	5	2
Where wait for the flood,	0	3½
<i>Third Flood.</i> —Track or row through the slack water of the <i>Bhuwaneepoor</i> and <i>Bayleygunj</i> Canals as far as <i>Kulloah Gung</i> ,	4	2½
<i>Fourth Ebb.</i> —Run through the <i>Dansa Khal</i> and <i>Hoseinabad Cut</i> , and descend the <i>Ishamuttee</i> River to the mouth of the <i>Coxalee</i> or <i>Goodlad's Creek</i> ,	2 10	1 3
		Second day
	Miles 46	34

23. In the foregoing scheme, I have taken no account of the wind, and moreover have supposed the Craft heavy and of considerable draught. With a light Boat and favorable wind, the same space may be traversed even in a single day.† Still it must be confessed, that nothing is gained in point of *velocity* by the new route, although one-third shorter than the Old Soondurbun Passage; for the same Tides *partially* employed in the one case, will transport a Boat over the longer distance with equal facility.

24. The Navigation by the old route may be thus divided:

	Miles.	Hours.
<i>First Ebb.</i> —Start from Eastern Canal before Ebb commences so as to reach the mouth of the Attarabanka Khal by low water,	30	8
<i>First Flood.</i> —Traverse the Attarabanka to Rampoor,	10	4
<i>Second Ebb.</i> —Descend to the Raymungul Khal,	9	4
<i>Second Flood.</i> —Ascend the Nowyee and Bara Koolya to the mouth of the Coxalee or Goodlad Creek.	15	6
	64	22

* Should the Bhamunghata Cut not be passable, the same object may be attained by running on to Tarda, and there awaiting the Flood.

† Starting from Mundaree at midnight with a favorable wind, I reached Balya Ghat by 8 o'clock the following morning.

25. Hence it appears, that there is a loss of a whole day in pursuing the new route for all Boats of considerable draught, yet capable of using oars, such as Bauleahs, &c. Heavy Boats of burden would probably employ two Tides in reaching Attarabanka, and thus perform the lower passage in the same time as would be taken in the Canal route.

26. On the other hand, the advantages of the Canal Navigation are such, as to ensure it a preference over the deep and dangerous streams of the Soondurbun forests, even at a little loss in point of time, for the frail Boats which ply from the Eastward, laden with wood, lime, fish, rice, mats, thatch, vegetables, and passengers.

27. The annexed Statement (Appendix E.) shews, that an average of nearly 200 Boats per diem pass through the Bhaminghata Canal, (and consequently through the whole line, or at least from Mundaree,) varying in size from the Dingee to the 1000 maund Pulwar, during the month of September, when it must be remembered, the whole Navigation from the Ganges is diverted from the Soondurbun route; so that it may be expected, that the traffic by the Canal will be at least doubled in the dry season. The greatest assistance is derived from the power of tracking along the Banks of the excavation, although it must be confessed, that the earth is piled in irregular hillocks in most places, without the convenience of an even pathway.

28. Among the items of my Schedule for the approaching season, I have ventured to insert a small Road Establishment of 50 Coolies, under a Jemadar and a couple of Peons, intended to be employed in levelling a footpath of sufficient width along one or both sides of the New Cuts; and it would certainly add considerably to the utility of the Canal, could a similar convenience be extended to the different natural creeks forming the main portion of the line. As the first step thereto, the jungle on the Eastern Bank from *Mundaree* to *Chytul* might be cleared away, as this is a spot where tracking will always be resorted to, to gain the remainder of the Ebb or Flood in passing to the East or West.

29. As connected with the conveniences of the Canal, I beg leave to point out the advantage of establishing Villages and Bazars at suitable places, provided always that a clear space shall be left open next to the Canal for a Road. Applications have been made to myself at various times by the Ryuts for permission to erect villages at Kantatulla, Bhungur Haut, &c., but I have not felt myself empowered to grant it.

30. Ferries also at Hoseinabad, Bhatpota, Bhungur, &c. have from necessity been established, but I am not aware that any farm has been granted of them by the proper Officers of Government. Neither indeed has any Toll been yet levied upon Boats navigating the Canal. It will rest with the Committee to frame, for submission to Government, such a Table of Tolls as they may deem suitable to the circumstances of the traffic, bearing in mind, that the old route is accessible to all, and that therefore the rates should be proportionally less than if the whole passage were commanded. It may be also beneficial to allow the transit to be open for a period, that the advantages of the route may be fully appreciated before hand.*

31. In the foregoing remarks, I have taken it for granted, that the line of Mofussil Canals, which has been once thrown open to Navigation, is hereafter to remain so, or that the operations designed for the next season will not interrupt the passage of Boats: arguing on the supposition, that the bunds and other impediments may be removed by the Dredgers. Another visit will, however, enable me to speak with more confidence on the subject, as I have some doubts whether it will not be necessary to bund the small Khal connecting the Bayleygunj Canal with the Gobra Khal, for the purpose of removing a vast number of roots

* The only places at which it will be necessary to establish Chokies to command the whole line of Canals, are

1. The Western mouth of the Bhojdigee Canal.

2. The Ishamuttee entrance of the Hoseinabad Canal.

Half Toll may be taken at each, or where full Toll is taken, a pass ticket should be given.

and trunks of trees, from which it is rendered impassable at Low Water. The bed also may require to be deepened a few feet. As for the Chytul Canal, I have already pointed out that its being closed will not interfere with the rest of the Navigation.

32. I will now recapitulate the items of my proposed scheme of Mofussil operations for 1830-31.

1. Two Dredging Boats, at 550 per month,	Rs.	6,600	0	0
2. Probable Extra Expense in removing 16 Bunds, at 50 per Bund, ...		800	0	0
3. Establishment for levelling and making a Tracking Path, estimated } at 250 per month,		1,500	0	0
4. Deepening the Chhota Gobra Khal and removing roots, &c. there- } from, 600 running feet, at 2,		1,200	0	0
5. Clearing away Jungle and forming a Tracking Path from Mundaree } to Chytul of $\frac{3}{4}$ mile,		1,000	0	0
Total Rs.		11,100	0	0

33. It has been usual to include among the Mofussil works, the repairs of the Eastern Canal Roads, and the construction of Water-courses thereto; but it seems more natural to class these with the operations of the Circular Canal, to which I shall now proceed to advert.

CIRCULAR CANAL.

1. *Suspension Bridges.*

34. The Masonry of the Narkooldunga and Manicktola Bridges was completed before the 1st February. The Chains were thrown across by Captain Baker in May, and these two Bridges were opened to the public in the beginning of the rainy season.

35. The charges of building have unfortunately been included under one general head, so that I am unable, without some trouble, to state, what each has separately cost. I will endeavour to make the distinction when the two other Bridges now in hand shall be also completed: that of the Bythukkhaneh Road is now ready for the Suspending Chains, &c.; and the Barrackpoor Road Bridge is nearly in the same state of forwardness.

36. I have ventured to make a few slight alterations in the Plan and Elevation of the latter Bridge, as will be seen by comparing the Plan now sent with that which accompanied the last yearly report, the chief differences are as follows:—

1. The width of the two carriage-ways has been increased from 12 to 13 feet, to allow additional strength in the standards for the support of the Chains, leaving $8\frac{1}{2}$ feet opening for the Roads.

2. The space between the two Bridges has been augmented from 4 to 6 feet, so as to allow of a foot-way between.

3. The Chains have been brought by Captain Baker to rest upon one bed, instead of being superposed, whereby the Upper Chain depended for support solely upon a cross beam above the Lower Chain.

4. As this Bridge forms a principal thoroughfare, and Bounds also the Chitpoor Basin, I have introduced the side stairs: they were designed indeed for all the Bridges, but do not seem urgently necessary elsewhere, the Banks being grassed and sloped instead.

5. From my communications with the Right Hon'ble the Governor General, I was induced to give an additional depth of 3 or 4 feet to the foundations of this Bridge, in case

of any eventual determination to deepen the Section of the Canal. The soil being an oozy sand, I was unable to penetrate to greater depth; and it will not be irrelevant here to remark, that this circumstance offers an almost insurmountable obstacle in the way of any Plan for deepening the Canal, as my brother himself pointed out in his Report upon Captain Schalch's original scheme.

37. The alterations above alluded to, will make a trifling addition to the Masonry abstract of this Bridge—more than compensated by the accommodation gained: still I expect to come within the Estimate, and, if approved, I would propose to build the Dum-Dum Road Bridge on a similar Plan. The excavations for the foundations of the latter Bridge have been delayed through the non-purchase of a small piece of ground, (No. 3, Division G,) through which it was proposed to conduct the temporary Road. The subject has been brought to the notice of the Committee on a former occasion.

38. In connection with the Bridges, may be conveniently introduced the side Drains to the several Roads leading from the City to the Canal. The only one of these completed, is the North Drain of the Narkooldanga Road: it is vaulted for the distance of 300 feet, having an interior Section of 7×6 feet. Three more of similar dimensions, but of less length, will be required, and an equal number of a smaller size; but I presume these necessary works have been included in the original scheme, and that no new Estimate is therefore necessary. Neither will it be requisite to advert to the sum entered into the yearly abstract as expenditure upon Bridges, &c., until the whole be completed; the present report being (for unfinished works) merely a statement of the progress made during the past year, and of the course to be pursued in the next.

2. *Flood Gates.*

39. The last Annual Report included the Flood Gates at Chitpoor among the operations for the ensuing season; but from the non-purchase of a portion of the ground, and from the season being already far advanced when I received charge, I deemed it prudent to postpone breaking ground until after the present rains, especially, as from the sandy nature of the soil, great difficulty might be expected in carrying the excavations to their requisite depth.

40. With regard to the Plan of the Locks and Bridges, I have perused with attention the observations made by my brother on the subject, and beg to record my acquiescence in the general principles laid down by himself for their construction. I have also before me, the one inch model alluded to in his last Report, to guide me in the execution of the work. Some few practical alterations may perhaps be suggested as the work proceeds, and the same argument, which induced me to deepen the foundations of the Bridges, will naturally oblige me to give even *greater* depth, if possible, to the foundations of the side and centre piers of the Locks; the floors however will remain at the level originally designed for them.

41. I observe that a second pair of River Gates has been introduced into the Plan since the Chunar Stones for the first pair were prepared. My connection with Benares will put it in my power to procure a second set without much difficulty.

42. Since Suspension Bridges have been adopted in every other part of the Canal, I am inclined to recommend that they should be substituted for the Wooden Draw Bridges at Chitpoor; all Boats entering the Canal will have to strike their masts, and it is of little

consequence whether they do so in the River or in the Basin. The Draw Bridges would have to be raised for every Boat, whether with or without masts, as they are fixed nearly on a level with the present Road; the Suspension Bridge might be elevated several feet, and thrown across the inner or Canal portion of the Locks, where the level of the water will always be maintained at the Zero of the guage.

43. The advantage of such a Bridge will be, that the Road communication of this great thoroughfare will remain uninterrupted; but the alteration requires to be more maturely considered before it can positively be proposed for the Committee's adoption.

3. Canal Excavations.

44. The number of Choukas of 729 cubic feet, brought to account this year has been 13,305, and the corresponding lineal measurement of Canal excavated, 6,083 running feet.

45. Of these excavations, 30 Lots, or 3,000 feet, complete the line from Sealdah to the Entallee Canal, so that the whole line from the unpurchased ground in Ooltadanga Southward, exhibits *superficially* an uninterrupted water communication.

46. Unfortunately, however, there are many unfinished Lots within this run, which will oblige me to lay a considerable portion of it dry again for excavation this winter. The accompanying Plan (Appendix F) points out the position of the impediments which are as follows:—

Lot Nos. 45, 46,	depth still uncut 6 feet,	ground purchased too late in season.
41, in part,	ditto, 12 feet,	temporary Bridge, Bythuckhana Road.
39, 40,	ditto, 7 to 8 feet,	ground purchased too late.
38,	ditto, 3 feet,	inactivity of Contractor Ramchund.
35, 37,	ditto, 5 feet,	ditto ditto.
12, 21,	ditto, 1 to 2½ feet,	unfinished Nos. of 1829.
1, 30,	ditto, 12 feet,	temporary Bridges, Narkooldanga and Maniktulla.
56, 57,	ditto, 13 feet,	unfinished Lots in Ooltadanga of 1829.

47. From the early rains this year, the finished Lots became so full of water in Ooltadanga, that at the first heavy fall on the 26th May, when the water poured in from all the City Drains, the partition Bunds all gave way, and a passage was at once opened into the Entallee Canal; this I had fully anticipated, but could have wished a few days delay to have enabled me to complete the excavations at once, leaving merely the remnants of Bunds to be hereafter Dredged away.

48. The direction of the excavations on the North Division of the Canal extended from the neighbourhood of the Dum-Dum Road Bridge, (with some interruptions as per margin), to Lot 27 of the Chitpoor Bason.

No. of Lot.	Depth remaining to be Cut.	Cause.	
1	20	Not begun.	A good deal of water accumulated in them, partly from the wetness of the season, and partly by oozing from below; the Division was finally flooded by the high Tides of the Hooghly entering through a branch of the Marhatta Ditch. This circumstance proved
2	10	Unbought.	
3	8	Ditto.	
4 & 15	10	Ditto.	
½ 12	20	Bridge.	
16	4	Defaulter	
20, 21, 22	8	Ditto.	

useful in protecting the sandy Banks of the unfinished Lots from being Cut into ravines by the rain. I propose to make a further use of the Marhatta Ditch in draining the works when the River falls, by deepening the Ditch to the Low Water level of the River, and inserting a temporary Sluice Gate at the Chitpoor Bridge, whereby I shall be able to command the lowest level of the Ebb. As soon as the Chains of the Barrackpoor Road Bridge

are thrown across, and the temporary Road removed, the same means will serve to Drain Divisions H. and G., and save, in a great measure, the expense of baling. Indeed, for all portions of the Canal where a few feet only remain uncut, I should propose to postpone operations until the Locks themselves are completed, as they will furnish a means of laying dry the whole extent of the Canal, with the assistance of a Bund, where it opens into the Entallee Canal, or the latter into the Lake.

49. The average rate of cost per Chowka of 729 cubic feet has been 2 : 5 : 2 $\frac{3}{4}$, or 0 : 2 : 2 $\frac{3}{4}$ in excess of the rates of last year. The excess is due to the greater breadth of the Lots in the Chitpore Basin (180 feet,) for which no provision was made in the contracts with the Sirdars; but an understanding existed, that they should be remunerated for the extra labour. I settled with them at an advance of 4 annas per Chowka over the usual rates, which is as nearly as possible proportionate to the increase of labour from the extra distance.

50. During the present season, I hope to enter into contracts on more favorable terms than heretofore, partly from competition among the labourers as the work grows slack, and partly from my paying the Sirdars direct; or, if through the agency of a head Sirkar, with the direct understanding, that he shall take no more than half an anna dustooree on all payments of this nature : whereas it is pretty clear, that he has hitherto taken a much larger proportion.

4. *Canal Roads.*

51. Although the construction of the Side Roads of the Canal did not form a specific item in the scheme laid down in the last Annual Report, I felt myself authorized by its inclusion in the original design of the Canal, to employ the parties of Coolies upon leveling the mounds of excavated earth during the season in which their other work was suspended. It was also very desirable, now that the Canal was in so advanced a state, to render the Banks accessible at once to the public. On the Eastern side of the Canal, the whole line of Road is thrown open, (with some few interruptions,) from Balyaghat to the unfinished Lots in Ooltadunga, because the slope of the country towards the Lake obviates the necessity of providing for the Drainage. On the Western side, the communication is still cut off by the several Drains of the Circular Road. It will be our first object to construct the Water-courses and Bridges required, and to throw open this Road also; but I shall need the instructions of the Committee as to whether it is the intention of Government, that either, or both of the Roads shall be made pukha. I have purposely retained a

height of 1 $\frac{1}{2}$ feet above the lower Road or Wharf of the Canal, (as per marginal section,) in case it should be deemed advisable to leave the Roads kucha for the present; but to any who have witnessed the wretched state of the Kucha Road along

the Banks of the Eastern Canal during the rains, when indeed the passage of wheel-carriages is prohibited, it will appear almost indispensable to lay the New Roads, or that on the Town side at least, with brick and khooa. Anticipating the concurrence of the Committee in this measure, I have entered into contracts for the fabrication of 30 lakhs of Bricks at various places along the Banks. I would strongly recommend to the Committee, that the Southern Road of the Eastern Canal should also be made pukka; as from the omission of a Bridge at the debouche of the Circular Canal, the whole traffic will be driven to the opposite side: and it has been proved, that no measure of temporary repair, even with khooa, will place it in a durable and serviceable state.

52. A sum of Rs. 250 was sanctioned for small Water-courses on this Road, part of which only seems to have been expended. I propose to continue this object, increasing the

dimensions of the Drains, which seem hardly sufficient to carry off the water as it accumulates.

53. The cost of levelling and making the Kucha Roads of the Circular Canal has amounted to between 30 and 40 Rs. per 100 feet running; but as the work has been subsequent to the 30th June, the explanations will more properly find a place in next year's Report.

54. I believe I have now touched upon all the points which need any observation, in the present limited scope of the Canal Superintendency. Brick-making occurs as an item in the annual schedule; but as it is subsidiary to the Departments of Bridges and Roads, a separate notice is hardly requisite. My brother suggested, that the position of the Canal, and the quantity of excavated brick-earth encumbering its Banks, would render it an eligible site for a Government Brick-manufactory. Such a purpose may well be kept in view, unconnected with the Canal Superintendence, since what remains to be accomplished in the latter Department, will furnish ample employment for the present season.

55. The cost of a kiln of Bricks, nominally containing one Lakh, has been upon an average Rs. 340; but as out of each kiln a deduction must be made of 25,000 for Jhama and unburnt Bricks, the price to be charged per Lakh upon the masonry abstracts will be Rs. 450.

56. For the present season, Contractors have come forward at lower rates than have been hitherto paid, but I do not feel thorough confidence in such reductions, although I shall naturally make the experiment.

5. Balances.

57. The amount of assignments in favor of the Circular Canal for 1829-30, including the Balance of the year preceding, was Rs. 1,73,111 : 7 : 2,* against which I have drawn to the extent of Rs. 1,04,607 : 7 : 2, up to the 30th June 1830. A large Balance therefore, both in this and the Mofussil Estimates, remains available before any new application need be submitted.

6. Outstandings.

58. Appendix C, exhibits a List of the Balances remaining to be recovered up to the 30th June. A part of these have stood over since 1826-27: those under the head of "Bhowaneepoor Canal 1827-28," are involved in the clashing of two Head Sirkars, each disclaiming responsibility. The Balances for the year 1829-30, are merely nominal, as most of them will be included in the Monthly Abstracts subsequent to June. By way of affording a clearer view of the outstanding account, the magnitude of which might at first sight appear large, I have classified the items under the several different heads enumerated in the margin, whence it results that about 10,000

<i>Outstandings.</i>			
Will be included in Canal Abstracts, Rs.	686	0	5
Ditto Road Contracts,	1,340	4	2½
Ditto Masonry ditto,	4,469	11	3
Received in Cash since 1st July 1830, ..	731	15	¼
Amount of Decrees obtained in Courts, ..	1,215	6	3
Prosecutions now pending,	1,180	9	2
Recoverable upon prosecution,	572	7	5
Total deemed recoverable, ..	10,196	5	8½
Parties Dead,	161	6	4½
Cases of hardship,	267	2	1½
Desperate Balances,	1,555	13	5½
Rs. 1,984 6 0			

rupees are recoverable, and 2,000 may be looked upon as doubtful; though many items of the latter List are by no means hopeless. I refrain from recommending that any sum should be passed to profit and loss until every effort shall have been tried for its liquidation.

* Of this sum Rs. 5,304 : 0 : 0 have been retransferred from the Collectorate to the General Treasury; but as the date has not been notified to the Canal Office, it still remains on the Books as a Balance of an assignment No. 51, (15th January 1827,) undrawn.

7. *Establishment.*

59. The last point to which it is my duty to advert in the present Report, is the fixed Establishment and Office of the Department.

60. As soon as the Mofussil operations of the season were brought to a close, the establishments connected with them were discharged, with the exception of a Chuprassee or two to assist the Sirkars in collecting the Outstanding Balances, and to keep a register of Boats traversing the Canals. Perceiving also, that there would be little occasion for more than occasional visits to the Soondurbun Canals, I at once reduced the establishment of Boats for the accommodation of the Superintendent; charging merely for the occasional hire of a Bhauleah, when employed for the purpose. As the Circular Canal works will in a short time become for the most part concentrated in the Shambazar and Chitpoor Divisions, I shall be enabled to effect proportionate reductions here also; but as the construction of the Lock Gates will need constant supervision, I may perhaps be compelled to take advantage of the permission allowed by Government, (as per Mr. Secretary Molony's Letter to the Canal Committee, dated 10th November 1829,) of engaging an active European or Native Mechanic on moderate salary, as an assistant or overseer in this work.

61. In the course of the foregoing Report, I have made no allusion whatever to operations beyond the Ishamuttee River, for two reasons:—1st, Because I conclude that the Government have suspended the prosecution of this branch of Major Schalch's design, until the success of the Western Division shall be fully ascertained; and, 2ndly, Because my duties in the Mint would at any rate render it out of my power to act as Superintendent of any works situated at such a distance from Calcutta.

JAMES PRINSEP,

Superintendent of Canals.

No. 128. *a.*⁽¹⁾

APPENDIX A.

CANAL DEPARTMENT, 1829-30.

*General Abstract of Expenses for Muffussil Works, for the season of
1829-30, from 1st July to 30th June 1830.*

*Working of Old Dredging Machine, from 1st July 1829,
to 30th June 1830—12 Months.*

To Workmen,	1,986	2	11½	
To twice caulking and repairing of Dredging and 4 Mud Boats, ...	813	8	11½	
To repairing Iron Works,	562	5	4	
To purchase of one Boat,	136	8	0	
To Contingencies,	440	13	10	
				3,939 7 1
Carried over				3,939 7 1

Brought forward, 3,939 7 1
*Working of New Dredging Machine, from 1st July 1829,
to 30th June 1830—12 Months.*

To Workmen,	Rs. 2,089 9 2
To once caulking and repairing of 4 Mud Boats,	58 10 6
To repairing Iron Works,	360 3 0
To Contingencies,	393 6 5½
	<hr/> 2,901 13 1½

*Bahaminghatta Canal, from ditto to ditto,
12 Months, 4,263 running feet, 2,474
Chowkas excavated.*

To Workmen for cutting Chowkas at 1/14 per Chowka,	4,334 12 0
To emptying Water,	684 4 0
To making and repairing Bunds,	1,829 4 3
To clearing Jungle,	345 4 0
To pinning in the Slope and Bunds,	85 6 0
To taking up Roots,	45 4 0
To opening the mouth of Canal,	68 12 0
To furnishing fresh Water to Workmen,	189 0 0
To Contingent, including Establishment and Coolies' Shed,	1,049 7 3
Average 3 : 7 : 10 per Chowka,	<hr/> 8,631 5 6

*Bhose [Bhoje] Digea Canal, running feet, 557½
Chowkas excavated.*

To Workmen for cutting Chowkas at 1 : 5 : 6 per Chowka,	749 5 1
To making Bunds,	440 10 4
To emptying Water,	43 14 0
To opening the mouth of Canal,	6 2 0
To Contingent, including Establishment,	340 14 9½
Average 2 : 13 : 4½ per Chowka,	<hr/> 1,580 14 2½
	<hr/> 10,212 3 8½

*Choytul Canal, 3,200 running feet, 2,140½ Chowkas
excavated.*

To Workmen for cutting Chowkas at 1 : 8 : 9 per Chowka,	3,307 15 9
To making Bunds,	251 6 0
To clearing Jungle,	99 12 0
To emptying Water,	166 2 0
To taking up Roots,	31 4 0
To furnishing fresh Water to Workmen,	78 0 0
To Contingent, including Establishment,	1,081 3 2½
Average 2 : 5 : 6 per Chowka,	<hr/> 5,015 10 11½
Carried over,	<hr/> 22,069 2 10½

Brought forward, 22,069 2 10 $\frac{1}{4}$

Bayley Gunge Canal, deepened 6,775 running Feet, 2,060 $\frac{6}{16}$ Chowkas excavated.

To Workmen for cutting Chowkas at 1 : 14 : 3 $\frac{3}{4}$

per Chowka, Rs. 3,902 2 2

To making Bunds, 987 0 0

To clearing Jungle, 341 6 0

To emptying Water, 606 0 0

To taking up Roots, 29 14 0

To furnishing fresh water to Workmen, .. 120 4 0

To cutting sandy mud over the Autty, .. 315 6 0

To Contingent including Establishment, .. 1,764 8 1 $\frac{1}{2}$

To wear and tear of Pumps, 145 15 7 $\frac{1}{4}$

8,212 7 10 $\frac{3}{4}$

To Workmen opening the mouth of Bhownepore Canal, 277 4 0

Average rate 4 : 1 : 11 per Chowka, .. 8,489 11 10 $\frac{3}{4}$

Balyaghatta Road Drain.

To Materials, Bricks, &c. 30 7 3

To Workmen, 13 12 11

To Contingent, 0 11 0

44 15 2

Sicca Rupees, .. 30,603 13 11 $\frac{1}{4}$

E. E.

Contents received,

JAMES PRINSEP,

Superintendent of Canals.

No. 128. a.⁽²⁾

APPENDIX B.

CANAL DEPARTMENT, 1829-30.

General Abstract of Circular Canal, for the season 1829-30, from 1st August 1829 to 30th June 1830.

6,083 running Feet, 14,357 $\frac{1}{2}$ Chowkas excavated.

To Workmen for cutting Chowkas at 1 : 11 : 10 $\frac{1}{2}$

per Chowka, 25,006 10 5 $\frac{3}{4}$

To emptying Water, 826 3 0

To making Drains and Side Road, 607 4 3 $\frac{1}{2}$

Carried over 26,440 1 9 $\frac{1}{4}$

Brought forward	26,440	1	9½
To pinning in the Slope of Canal and Drains,	218	10	0
To filling Tanks for Side Road,	40	2	0
To laying grass in the Slope of Canal, ..	62	0	0
To taking up Roots,	4	2	0
To making temporary Wooden Bridges, ..	500	8	9
To breaking down pukka small Bridges and removing Rubbish,	97	2	0
To removing earth from the Bank of Canal,	208	0	0
To making a Wind-mill for drawing Water,..	209	15	3¼
To cutting floors of Houses,	120	6	0
To making Side Bridges,	35	5	0½
To making a Stone Cart,	122	12	11¼
To cleaning mud from the bottom of Canal and clearing Drains,	116	12	0
To making and cutting Bunds,	73	11	6
To making a Flood Gate Mould, and ex- pense for landing Chunar Stones,.. ..	336	12	3½
To making and repairing Sheds,	802	3	8¾
To Contingent, including baskets and esta- blishment,	4,347	3	7½
Average rate 2 : 5 : 2¾ per Chowka, —————	33,735	12	11½

*Expenses for Narculdanga, Manicktulla, Boy-
tuckhana and Barrackpoor Road Bridges.*

To 90,880 cubic feet of Masonry for Narcul- danga and Manicktulla Bridges,	12,944	11	5
To making Road Way in both sides of ditto Bridges,	1,124	12	0
To filling earth in the wings of Bridges and Chain Piers,	416	5	10½
To making a small Side Bridge and Pukka Drains in the Boytuckhana and Narcul- danga, 3,400 cubic feet Masonry,	478	10	10
To cutting Foundation of Boytuckhana and Barrackpoor Road Bridges,.. .. .	2,059	11	4½
To emptying water of Foundations,	208	13	0
To pinning in the Foundations,	599	10	8
To Contingent, including carriage of Bricks, &c. and making a Road for passing Hackeries from Sambazar to Manicktulla,	2,535	7	2
Average 22 : 6 : 1 per 100 cubic feet, —————	20,368	2	4
			54,103 15 3½
Sicca Rupees,	54,103	15	3½

(NOTE.) Amount as per Monthly Report of June 1830, 36,908 12 10½
Amount of 3 bills for Masonry Work of last year, August, September and
October 1829, which is not included in the Report, 17,195 2 5

54,103 15 3½

JAMES PRINSEP,

Superintendent of Canals.

No. 128. a.⁽³⁾

APPENDIX C.

CANAL DEPARTMENT of 1829-30.

List of Outstanding Balances to 30th June 1830.

Names of Sirdars	Rs.	As.	Ps.	Rs.	As.	Ps.	REMARKS.
CHALTABARYA CANAL, 1826-27.							<i>Sirkar employed—Luckinarayun Mokerjee.</i>
Kishenmohun Sirkar,	215	1	4½				Received in August 1830.
Parbuttychurn Ghosal & Mud- doosoodun Chuckerbutty, .. }	78	13	9				Originally 150, half paid by Mudoosoodun who is since dead, his partner is referred to the Magistrate of Barasett to come to a settlement.
Muneeruddee Sirdar,	247	3	8½				Has no assets, the Canal filled with water, and his coolies ran away.
Royemohun Doss,	142	4	3				He and his surety live in Calcutta, and will pay if prosecuted.
Takoor Doss Ghose,	240	5	4½				Was prosecuted and imprisoned for 3 months, hopeless case.
Tarachaund Roy,	254	1	1				A decree obtained in the Court of Requests.
Taraneechurn Bosoo and Mul- lookchaund Sirdar, }	423	4	3½				Ditto.
				1,601	1	10½	
BAHAMINGHATTA CA- NAL, 1827-28.							<i>Sirkar employed—Luckinarayun.</i>
Luckhun Sirdar,	161	6	4½				Lukhun is dead, his surety promises to bring the money in a few days and quash the prose- cution in the Suburb Court.
Hissamdee Sirdar,	534	15	10				Papers handed to Mr. Waddington by late Superintendent, who wished to sue a warrant.
Sibchunder & Jugomohun Bosoo,	6	7	11				This defaulter has paid up 800, and begged to be excused the balance.
Emamdee Sirdar,	11	6	0				100 already paid, the Balance recoverable.
Woodhub Sirdar,	538	0	10½				Decree obtained and property under seal, but vukeel ill just now.
Ramrutton Boyne,	2	0	6				Recoverable.
				1,254	5	6	
DITTO, 1828-29.							<i>Sirkar—Luckinarayun.</i>
Rugoonauth Doss,	10	0	0				Promised to pay 1st October.
Ramrutton Boyne,	17	2	0				Sent a man to collect this.
Titto Sirdar,	23	14	2½				Received in August 1830.
Woodynarrain Mundle,	15	4	5				Sent a man to collect.
Royechurn and Kissenmohun, ..	104	4	9				Reduced from 309 recoverable.
Goluckchunder Banerjee,	95	7	3				47 Rs. paid in August 1830.
Ketabdee Sirdar,	209	7	10				Regular suit to be instituted.
Dhurnidhur and Fuckeerma- hmed Sirdar, }	357	3	9				He deposited the Potah of his house as secu- rity, but a suit and decree must be first obtained.
				832	12	2½	
BAHAMINGHATTA CA- NAL, 1829-30.							<i>Sirkar—Luckinarayun.</i>
Gobindpersaud Mundle,	18	10	5				A man sent to collect.
Haranund Sirdar,	8	11	0				Received in August 1830.
Sunnassee Sirdar,	0	0	0				
Rammohun Doss,	50	15	3				20 Rs. received in September 1830, balance will be paid in October.
				78	4	8	
BHOWANEEPOOR CANAL, 1827-28.							<i>Sirkars employed,</i> <i>Gooroopursad, Luckinarayun's man.</i> <i>Hurnath Roy, Captain P's. man.</i>
Sitaram Moochee, &c... ..	8	0	3				
Junglee Gurramee,	36	15	4				Gooroopursad Bonerjee was sent in January 1830, to recover these Balances
2nd Gopaul Sirdar,	27	1	0				He collected 40 Rupees and a few iron stores, he was taken ill and returned.
Hissamdee Sirdar,	45	7	4				
Nowabdee Sirdar,	41	12	6				
Mokim Sirdar,	28	8	6				
3rd Gopaul Sirdar,	55	3	3				
Jummiut Sirdar,	67	0	2				
Akbar Sirdar,	30	8	9				Humath Roy lives in Govindpoor, Nuddya Zillah.
Carried over, ..	340	9	1	3,766	8	2½	

Names of Sirdars.	Rs.	As.	Ps.	Rs.	As.	Ps.	REMARKS.
BHOWANEEPOOR CANAL, 1827-28.—(Continued)							
Brought forward,....	340	9	1	3,766	8	2½	
Mokim Sirdar,	51	6	0				
Myzudin Sirdar,	49	6	6				
Doya Mundle,	3	4	2				
Bhoyrub Sirdar,	57	0	3				
Ketabdee Sirdar,	39	5	0				
Mullookhund Sirdar, ..	12	12	6				
Keenoo Sirdar,	27	3	10				
Hazaree Sirdar,	8	15	3				
Sonye Sirdar,	12	2	0				
Chamoo Sirdar,	60	11	6				
Auzeemuddeen Sirdar, ..	150	9	11				
Bauker Sirdar,	21	4	10				
Hossenuddeen Sirdar, ..	20	15	3				
Gorye Sirdar,	35	14	8				
5th Gopaul Sirdar,	19	13	7				
Haubizulla Sirdar,	23	0	0				
Joychunder Sirdar,	6	2	0				
Bungsee Sirdar,	0	2	5				
4th Gopaul Sirdar,	0	5	6				
				941	0	3	
BHOWANEEPOOR CANAL, 1828-29.							
Kunnye Sirdar,	21	14	11				
Emmamdee Sirdar,	10	0	0				
Mutteulla Sirdar,	169	0	6				
Bholye Lolmahamed, ..	110	2	7				
Goluck Sirdar,	51	0	0				
Kistno Sirdar,	27	6	0				
Ramchand Sirdar,	24	15	10				
				414	7	10	
BAYLEYGUNGE CANAL, 1829-30.							
Sumus and Koosye,....	0	11	6				
Kurrim and Cossim, ..	140	13	9				
Calachaund Sirdar, ..	10	8	8				
Ramlochun Sirdar, ..	5	15	4				
Durpnarain Sirdar, ..	13	1	11				
Sreehurry Sirdar,	0	2	3				
Ramhurry and Co. Moochees, ..	5	5	6				
Netye and Buddo Sirdar,	27	11	1				
Pursoola Sirdar,	15	15	11				
Madaree Sirdar,	5	2	6				
Haubizulla Sirdar,	1	1	4				
Emamdee Sirdar,	16	8	7				
				243	2	4	
KULLOORDAM.							
Lolmahamed Sirdar, ..	..	..	..	7	5	2½	
CHOYTUL CANAL.							
Rammohun Sirdar, ....	..	..	..	12	4	0	
CIRCULAR CANAL, 1829-30.							
Manick Mookerjia,	138	5	10½				
Sittanauth Mookerjia, ..	52	8	0				
Damoodur Sirdar,	125	12	9½				
Sibchunder Chuckerbutty, ..	29	10	10½				
Ramjee Doss,	364	13	4½				
Ramchunder Sirdar, ..	351	15	6				
Cootub, Bricklayer Mistry,	2,549	14	5				
Nubin Sirdar,	50	0	0				
Palaram Sirdar,	180	6	3				
Soobul Sirdar,	2	9	3				
Carried over, ..	3,816	0	4	5,384	11	10½	

Names of Sirdars.	Rs. As. Ps.	Rs. As. Ps.	REMARKS.
CIRCULAR CANAL, 1829-30. <i>—(Continued.)</i>			
Brought forward,....	3,846 0 4	5,384 11 10½	
Bindabun Sirdar,	74 5 10½		
Sutterghun,	25 11 6		
Ramhurry Ghose,	309 4 10½		
Cauloo Malick,	304 8 7½		
Joogul Sirdar,	64 11 9		
Hurrypersaud Sirkar,	82 10 9		
Gooroopersaud Bhuttacharge, ..	58 6 5		
Gungahurry Bhuttacharge,	91 0 0		
Khoa-breaking account,	200 0 0		
Bindabun—Soorkee-pounder, ..	600 0 0		
Cosseenauth—Jhama ditto,	125 0 0		
Haran Sing—ditto,	75 0 0		
Bindabun and Cosseenauth—do.	94 0 0		
Hurrypersaud—ditto,	50 0 0		
Ramhurry—Brickmaker,	48 4 3		
Ramjee Doss—ditto,	110 6 11		
Bachoo—Cartman,	50 0 0		
Emamdee—ditto,	586 8 7		
		6,795 15 10½	
Total, ....	.. ..	12,180 11 8½	

JAMES PRINSEP,
Superintendent of Canals.

No. 128. a.⁽⁴⁾

APPENDIX D.

Comparison of the depth of water in the Eastern Canal on the 26th December 1827, and after Dredging on the 9th September 1830. N. B.—The Level of water at Koolya Bridge was 6 feet 1 inch on the first measurement, and 8 feet 3 inches the second ; 2 feet 2 inches has therefore been deducted from all the second measurement.

Place.	Average Depth, 26th December 1827.		Average Depth, 9th September 1830.		Difference.		
	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.	
From Fish Bazar to { 500 feet, }	3	2	5	0	1	10	
500 to 1,000,	3	4	5	9	2	5	
1,000 to 1,500,	3	3½	6	0½	2	9	
1,500 to 2,000,	3	2½	6	2	2	11½	
2,000 to 2,500, ...	2	11	6	3	3	4	
2,500 to 3,000,	3	1½	6	7½	3	6	
3,000 to 3,500,	3	3¼	5	9	2	5½	
3,500 to 4,000,	3	6	5	7¾	2	1¾	
4,000 to 4,500,	3	3	5	4¾	2	1¾	
4,500 to 5,000,	3	9	5	2	1	5	
Total 5,000 feet,....				Average	Feet. 2	Inches. 6	Deepened by the action of two Dredging Boats for 2½ years.

JAMES PRINSEP,
Superintendent of Canals.

No. 128. a.^(4½)

Soundings taken in the Eastern Canal at every 100 feet from Kood Ghat to Koolya Bridge, on the 10th October 1830. The guage standing at 6 feet 1 inch on the 26th December 1827. This part of the Canal was deepened 4 feet by Chowka work in 1827.

Kood Ghat within Bund.	From Fish Bazar.		Kood Ghat within Bund.	From Fish Bazar.		
	5,100 feet.	6 1		300	5 10½	
	200	5 7		400	6 1½	
	300	5 4		500	5 10½	
	400	5 1		600	5 7	
	500	5 4		700	5 8	
	600	5 10		800	5 8	
	700	6 1		900	5 8	
	800	5 10		9,000	5 8	
	900	5 5		100	5 4	
	6,000	5 9		200	5 9	
	100	5 1		300	5 11	
	200	5 6		400	5 4	
	300	4 7	Mouth of New	500	3 8	} Filled by action of the New Canal.
	400	5 0	Canal, . . .	600	4 4	
	500	5 0		700	5 4	
	600	5 3		800	6 0½	
	700	4 7	Godown, . . .	900	6 1	
	800	4 10		10,000	6 4	
	900	5 4		100	6 4	
	7,000	5 1		200	6 5	
	100	6 1		300	6 6	
	200	5 7		400	6 4	
	300	5 7		500	6 6	
	400	5 10		600	6 7	
	500	5 3		700	6 5	
	600	5 9		800	6 1	
	700	5 7		900	5 5	
	800	5 7		11,000	5 5	
	900	5 11		100	6 1	
	8,000	5 9		200	6 1	
	100	5 7		300	6 1	
	200	5 8				

J. P.

No. 128. a.⁽⁵⁾

APPENDIX E.

Statement of Boats passing through the Bahminghatta Canal.

Date.	Large Boats.	Middle-sized.	Dingee Boats.	Saultee Boats.	Total.
September 1830.					
1	39	23	79	27	168
2	37	10	86	19	152
3	25	33	103	26	187
4	9	24	99	15	147
5	46	21	112	7	186
6	11	14	125	5	155
7	27	19	101	9	156
8	41	13	99	23	176
9	38	26	103	17	184
10	19	15	73	11	118
11	36	29	109	15	189
12	41	11	102	35	189
13	39	27	137	28	231
14	44	11	105	13	173
15	69	31	83	7	190
16	29	26	113	23	191
17	27	18	96	23	164
18	33	23	114	25	200
19	14	37	49	29	129
20	28	46	102	21	197
21	65	55	87	33	240

JAMES PRINSEP,

Superintendent of Canals.

No. 130.

No. 173.

TO MAJOR J. N. JACKSON,

Member and Officiating Secretary, Canal Committee.

SIR,

I have deferred replying to your Letter, dated the _____ until I should have revisited the Kullooar Gunj, and thus be better prepared to give an opinion on the subject of the proposed Dam.

2. I have already expressed my sentiments to the Committee, that the design was judicious; but the difficulty of execution and expense appeared to counterbalance the advantages to be hoped for from its accomplishment.

3. The general effect of a free communication between the Canal and so many broad Tide-streams, is to cause a rise and fall in each branch of the excavation to the full extent of the Tide-lift; thus at High-water giving ample water for the passage of the largest Craft, and at Low-water laying the bed nearly dry in many places. Provided the Cuts be not of too short intervals, such a state of things has its advantages. From Husunabad to the Cheetpoor Khal there are three Canals, intersected by two large Khals, the Kullooar and the Gobra, which serve alternately as feeders and drainers to the Bhuwaneepoor and Bayleygunj Canals. The whole united distance is but six miles, and is therefore capable of being traversed with ease on the top of one Flood Tide; the only inconvenience felt proceeding from the alternating Currents, which are however in some respects advantageous, as they equally effect the passage to or fro, although again from their greater velocity, these Floods oppose an obstacle to heavy Craft, which would be avoided by a Channel of greater length, and consequently of gentler slope.

4. There can be little doubt, that to place the Sundurbun Navigation upon the best footing as a Canal, the whole line should be divided into two branches: 1st, the Eastern branch reaching from Husunabad to Cheetpoor as above stated, six miles in length, passing the Kullooar Gunj and the Gobra Khal, which must be strongly bunded; 2nd, the Western branch extending from Kooltee to Bahmunghata, and intersecting the Doodbeebee Khal and Kanta Tulla in like manner firmly bunded; this line would have a length of 13 miles, and from the Tides of the Tarda Nala being earlier than those of the Kooltee, there would be a gentle Current to the West at the time of High-water, which would in a great measure prevent the deposition of silt; the same thing now happens while the Kanta Tulla terminates this Canal, and my recent inspection proves, that it has not materially suffered from deposition, although contrary to the hypothesis upon which Major Schalch's scheme was framed, the water of the Sundurbund Creeks appears every where to hold in suspense a notable portion of silt,* at least during the present season.

5. The question then of the Kullooar Dam resolves itself into the more general one, whether the New Navigation shall be that of a real Canal, or of a system of Tide passages as at present. To render it the former, will involve an expense of full 50,000 Rupees upon the three large Bunds, besides their constant protection from accidents. I mention this precaution from having just perceived, that the several Bunds of the Doodbeebee Khal have been entirely carried away during the last rainy season, although I imagined, that the stream in question had been permanently closed. The Zemindars have perhaps favored the re-opening, for the sake of the fisheries now established on the spot.

* 100 Cubic inches let fall 1 grain of deposit in the course of an hour's repose; this comprehended all the grosser particles. According to this Estimate, it would take 4,000 Tides, or $5\frac{1}{2}$ years to raise the bed of the Canal 1 foot, by the process of deposition alone.

6. To retain the present system, obviously costs no further trouble, excepting in the unavoidable repairs which would be necessary in either case, and in the completion of an efficient tracking path to aid the Boats in stemming the stronger currents.

7. I am inclined, therefore, still to recommend the Committee to leave the works as at present, at least for a year or two, when a criterion may be formed of their success. Already the greater part of the Navigation has been attracted into the New Channel, and I encountered Boats of the largest size (1,000 Maunds) on my route. The Wood Boats from the Roymungul tell me, that they save three days in their trip, besides the diminution of danger. With a Bauleah I have before stated, that the saving in time would not be so manifest. I myself reached Husunabad by the old route in $2\frac{1}{2}$ Flood and 2 Ebb Tides, and returned in 3 Floods by the new passage.

8. Should the Committee adhere to their opinion in favor of Bunding, I beg to suggest, that the first experiment might be made with advantage upon the Kantatulla, which is somewhat smaller than the Kullooar Gunj, and more easy of access. The undertaking would require the whole of the present year for preliminary preparations, such as opening a Road through the wet marshy jungle; collecting a mound of earth on either side; preparing pile-drivers; and perhaps driving a row or two of the main piles. I should prefer the method of filling in the earth from the centre towards the sides, as the bed would then be raised more gradually, and with the same discharge of water, the task would be divided into two embankments of minor difficulty.

9. I perceive that the remains of the Kullooar Bund still occupy one-third of the width of that stream, and that the depth of the remainder is increased to about 32 feet at High-water. One circumstance may have rendered that undertaking more hazardous at the time than it would be at present; namely, that the Husunabad Canal was not then opened, and consequently the rise and fall of the Tide was felt in all its strength on one side of the Bund; whereas now, by the effect of this outlet, aided by the Bayleygunj Canal, the level of the water on the interior would approximate within a few feet of that of the Kullooar.

10. I beg leave once more to remind the Committee, that I should be unable to bestow an undivided attention upon a work at such a distance from Calcutta, and without it, there would be considerable risk of failure. As to an Estimate, I feel quite unequal to attempt one; and I can only submit, that the first experiment cost Rs. 15,000, and that it failed for want of hands; that therefore, even Rs. 20,000 would not be an unreasonable sum to enter into any calculation of the expediency of the measure.

I have the honor to be,

Sir,

Your most obedient servant,

JAMES PRINSEP, *Superintendent of Canals.*

BAHMUNGHATA WORKS,

3rd December, 1830.

No. 131.

No. 174.

To MAJOR J. N. JACKSON,

Member and Officiating Secretary of the Canal Committee.

SIR,

As a Supplement to the scheme of works for the season 1830-31, set forth in my late Report to the Committee, I beg leave to recommend, that the following be included as the result of my present visit of inspection:—

1st. The clearing away of the Jungle and making of a towing path from the mouth of the Bahmunghata Canal to the Tarda Khal, length 3,500 feet.

Estimated expense 1,000 Rupees.

The Boats have to force their way against both a reverse Ebb (if I may so call it, for the latter half of the Ebb runs up this Creek and through the Canal to Kantatulla,) and the first of the Flood, so as to reach the main Channel Tide which carries them to Calcutta.

The Road now in progress along the Banks of the Canal promises such advantage, that I propose to carry it through the Marshy Jungle at once to the Kantatulla and Boj-diggee.

2nd. The 1,200 feet of the Bahmunghata Canal which remained incomplete last season, although passable at High-water, are a great impediment to Navigation at Low-water, or half Tide. It will be therefore advisable to enclose this portion at once, and complete it to the requisite depth. This requires no new Estimate. The expence may be about Rs. 1,000.

3rd. In the Chultabarya Canal, for a space of 500 feet in length, the Banks (apparently a good sandy soil) have sunken in, and raised the bed of the Canal three feet. This forms the only impediment in the whole line to Craft of a large draught; but I know not how to remedy the evil without once more suspending the Navigation. I will try the Dredgers, but fear that the ground is too hard for them.

4. The Doodbeebee Khal, which was Bunded in three places, is again open: this should be closed without delay, and will cause an outlay of 500 Rupees.

5. The Chytul Canal has gained so much in section by the strong Currents through it, that it is quite unnecessary to do any thing further to it this season.

6. The 500 feet of the Bayleygunj Canal, of which one Chouka remained uncut last season, presents difficulties in consequence; but the Banks are of a sliding nature, and the bed sandy; if the attempt to deepen this is to be made, no time should be lost: the bed is dry at Low-water.

7. I have been obliged to put a new chain for the Dredger, in hand; as the one in use is no longer in a serviceable condition. This, with a new set of Buckets, will come to about Rs. 800.

I have the honor to be,

Sir,

BAHMUNGHATA,
3rd December, 1830.

Your most obedient servant,
JAMES PRINSEP, *Superintendent of Canals.*

No. 132.

No. 169.

TO THE SUB-TREASURER.

SIR,

The records, &c. of the Canal Committee's Office having this day been made over to the Secretary to the Military Board, agreeably to the orders of the Right Honorable the Governor General, as promulgated in the Government Gazette of the 16th instant, I have the honour to transmit herewith, per Debnarain Banoorjee, for deposit in the General Treasury, the sum of Sicca Rupees Ninety-seven and two annas, (97 Rs. 2 As.), being the amount proceeds from the sale of old materials and rents collected, the property of Government, from the line of the Circular or Ooltadangah Canal, up to this date.

I have &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
20th December, 1830.

(Signed) J. N. JACKSON,
*Member performing the duty of Secretary,
Canal Committee.*

NOTE.—The Municipal Committee do not think it necessary to print those Papers which have been omitted to be printed of the Index to Appendix H.—J. M.

NOTE.—The Municipal Committee have thought it necessary to print the following further Papers of the printed Index of Appendix H.
J. M.

No. 13.

No. 18.

TO LIEUTENANT SCHALCH,
Superintendent of Canals.

SIR,

The Canal Committee having had under their consideration and examination, the line of the proposed Canal between Koolna and the Eastern Canal, as laid down in the printed map, are of opinion that it would be extremely desirable to straighten the line between the following points—

1st. Between Bamunghatta and Cheltabaria.

2nd. Between Deacol and Banka.

I am therefore directed by the Canal Committee, to request you will do them the favor to give them in the fullest manner your sentiments on the points above adverted to, they will at the same time be glad to receive such suggestions as you may be able to offer, on the expediency of correcting any other parts of the projected line of Canal from Koolna towards Banka. The Committee request you will accompany any proposed alteration, with a specification of the additional expense that would thereby be incurred—forwarding plans of the revised line, in explanation of your suggestions.

I have the honor to be, &c.

(Signed) J. N. JACKSON,

Secretary to the Canal Committee.

[CALCUTTA.
 24th June, 1823.]

No. 15.

TO CAPTAIN JACKSON,
*Assistant Quarter-Master General,
 Secretary to the Canal Committee.*

SIR,

In reply to your letter of the 10th ultimo, conveying the opinion of the Committee, that it would be desirable to straighten the line of the proposed Canals between Bamunghatta, and Cheltabaria, and between Deacol and Banka, and calling on me to state my sentiments on these points, I beg you will represent to the Committee, that, under the impression that the former of the two Canals, might be made at a comparatively trifling expenditure, I lately surveyed, and minutely examined the country between Bamunghatta and Cheltabaria, in order to ascertain the practicability of the measure, and the expense that would attend it.

I have now the honor of transmitting a map of the Country between the above mentioned places,* and of informing the Committee, that there are no local objections to the formation of a Canal, in the proposed direction, the ground being an uniform flat, raised about a foot above high water mark, with exception to that part lying between the two Nullahs, which flow from the Pooroob Dhapa, or Eastern Lake, which is inundated at high

* No. 1.

water to a depth of from one to two feet, and is besides covered with the common low Sunderbund Jungle. The country being inundated in the manner I have described, is favorable for Canal operations, as less cutting will be required. The expense of clearing the Jungle I have before shewn to be very trifling. The direction of the Canal, I would propose to be that marked on the plan, passing between the Koorobarya and Byrampoor villages; it should join the present Sunderbund passage at the mouth of the Koorookhaul.

The length of the Canal, will therefore be five miles one furlong, the rise and fall of the tide when the Canal is opened, will be about seven feet; and as we may take the average height of the ground above high-water mark to be one foot, and allowing a depth of seven feet in the Canal at low water, the depth to be excavated will be fifteen feet. If the Canal be made with a breadth of eighty feet at low water, its section will be $1,222\frac{1}{2}$ square feet, and the cubic contents to be excavated will be 33,080,850 feet, or 45,379 Chowkas, which, at 1 R. 8 As. per Chowka, will amount to S. Rs. 68,068.

This estimate supposes the sides of the Canal to have a slope of one half feet horizontal to one perpendicular.

The above rate of 1 R. 8 As. is taken as an average between the first and second Chowka in depth.

Allowing a space to be cleared of 100 feet in breadth on each side of the Canal, the distance being one mile six furlongs, the expense of clearing the Jungle at 2 rupees the Beegah will amount to Sicca Rupees 390.

As the Canal will pass through three miles three furlongs of cultivated land, the price of which may be taken on an average at 10 Rs. a Beegah, the quantity of land required, will be 376 Beegahs, and will amount to Sa. Rs. 3,760. The whole expense of the Canal will therefore amount to Sicca Rupees 72,218.

The Committee will observe, however, that in the original estimate a sum of Sicca Rupees 9,124 is appropriated to bunding the Bedadoory Nullah from Narainpoor to Tardah; as this Nullah will be deserted on the formation of the Canal, the latter sum must be deducted from the former, in order to shew the expense that will ultimately be incurred in the improvement of this part of the line.

I have also the honor of laying before the Committee a map of the country between the Juboona river and Chowmooah Nullah.* I beg the attention of the Committee to an alteration I would propose on this part of the original plan, in consequence of my having lately been furnished with a more accurate map of the country by Ensign Prinsep, of the Engineers, who is at present engaged on a minute survey of the tract of country, lying in the direction of the intended Canals.

In this map both the original, and the proposed line of the connecting Canal, are laid down, the former joining the Chowmooah Nullah at Bussera, and the latter at the junction of the Teoree with the Chowmooah, about 3 miles to the Eastward of Bussera. By carrying the Canal from Husseinabad to the latter point, two miles of excavation will be saved, whereas the distance by the Canal, between Husseinabad and Bussera will be increased scarcely a mile. The estimate for the original Canal, 9 miles $3\frac{1}{2}$ furlongs in length, being 1,00,583 Rs. that for the proposed one of 7 miles 3 furlongs will amount to Sa. Rs. 78,601, consequently by adopting the proposed, instead of the original line, there will arise a saving of Sa. Rs. 21,982. If this saving be carried to the account of the Canal between Cheltabaria and Bamunghatta, the expense of which, after deducting 9,124 Rs. (the sum assigned for bunding the Bedadoory, as stated above) amounts to Sa. Rs. 63,094—the expense of the proposed alteration of the original plan, between the Juboona River and Calcutta, will therefore amount to Sa. Rupees 41,112.

It will be observed that the Canal now proposed between Husseinabad and Bussera passes through a greater extent of *jungle* than the *former* one. This does not, it appears to

me, form any objection, as, from a late conversation I have had with one of the principal Landholders in that neighbourhood, I have every reason to anticipate, through the means of the Canal, the speedy cultivation of the country lying to the Northward of it.

No other object will be gained by the proposed alteration in the direction of this Canal than the saving of expense before mentioned, but by the formation of the Canal from Bamunghatta to Cheltabaria, the route between these places will be shortened one half in point of distance, and 6 hours in time. The present passage from Tardah to the Salt Lake, which is extremely disagreeable, in consequence of its lying for the greater part through jungle, and from the strong current which sets down it from the Lake, during the Rainy Season, will be avoided by the adoption of the plan now proposed.

With regard to the Canal between Deacol and Banka, I beg you will inform the Committee, that I have not at present a sufficient local knowledge of the country in that direction to enable me to give a decided opinion on the subject.

In the beginning of next month, it is my intention to proceed into the Sunderbunds, to examine the state of the country in the direction of the Canals during the height of the rains; should it then be in my power, I shall endeavor to acquire such information, as will enable me to reply fully to this part of your communication.

I have the honor to be,

Sir,

Your obedient servant,

(Signed) J. AUG. SCHALCH, Lt.

*Superintendent of Canals, and Agent for the
Preparation of Suspension Bridges.*

(A True Copy)

J. JACKSON, Captain,

Secretary Canal Committee.

CALCUTTA,
25th July, 1823.

No. 16.

No. 39.

To H. MACKENZIE, ESQ.

Secretary to the Government, Territorial Department.

SIR,

The Canal Committee having, during the course of their proceedings, had occasion to advert to the line of Canal towards Koolna, as originally proposed by Lieutenant Schalch, were struck with the windings existing in it, and it appearing to them, that in an undertaking of so useful and important a nature, a line of Canal the most direct, and that would at the same time afford the most facile Navigation, was the most desirable to be adopted, they accordingly directed me to call upon Lieutenant Schalch, to ascertain whether an improvement in the line between the undermentioned points, could not be suggested, viz. from Bamunghatta to Cheltabaria, and from Deacol to Banka, and while offering such suggestions, to state for the information of the Committee, what would be the increased or diminished expense of such alterations.

I have now the honor, by order of the Committee, to submit to you for the information of Government, the Copy of Lieutenant Schalch's reply to the above communication,

together with Copies of the Plans therein adverted to—in the latter are exhibited, the line originally suggested, as also that, at present proposed to be adopted.

The Committee having fully considered the alteration proposed, beg to recommend its being carried into effect, as being calculated in every way, to improve the important undertakings entrusted to their management, particularly with reference to the saving of time not only in the passage of the tract immediately adverted to, but throughout the whole line of Canal, as the plan No. 1, will at once shew. The tide on leaving Baliaghat, will only take you as far as the junction of the present Channel with the Budadoory (where it becomes necessary to wait until the Flood makes) whereas by the proposed line, no obstacle would offer itself to Boats, going at once to Cheltabaria, and in the same manner throughout the whole of the Navigation to Koolna.

This saving of time, and improvement in the Navigation, the Committee consider more than sufficient to counterbalance the increased outlay, as estimated by the Superintendent of Canals.

The result of the examination, about to be* made by Lieutenant Schalch, between Deacol and Banka, shall be forwarded to Government, as soon as the report is received from that officer.

I have the honor to be,

Sir,

CALCUTTA,
30th July, 1823.

Your most obedient servant,

J. JACKSON, *Captain,*

Secretary Canal Committee.

No. 18.

No. 795.

TO CAPTAIN J. N. JACKSON,

Secretary to the Canal Committee.

Territorial Department. Revenue.

SIR,

I am directed by the Right Honorable the Governor General in Council to acknowledge the receipt of your letter dated the 30th ultimo, with its enclosures, relative to a proposed alteration in the direction of the Canals between Bamunghatta and Cheltabaria and that between Deacol and Banka.

2. The proposed cut between Bamunghatta and Cheltabaria, as exhibited in the plan No. 1, will obviously be a great improvement; and though the expense is considerable, (estimated at Sicca Rupees 63,094,) the Governor-General in Council fully concurs with the Committee in opinion that the charge will be more than compensated by the advantage.

3. The proposed change in the line of communication between the Chowmooah Nullah and the Juboonah, exhibited in the plan No. 2, by which a saving of Rupees 21,982 is expected to be secured, seems to be likewise judicious.

4. Both proposals therefore are authorized to be adopted.

I have, &c.

COUNCIL CHAMBER,
The 21st August, 1823.

(Signed) HOLT MACKENZIE,

Secretary to Government.

* The result never reported—but there is a notice in a communication from Major Scbalch, dated 19th October 1824, (Appendix H. p. 16, line 6 from bottom) of a Survey by him between Deacol and Hoseinabad.—J. M.

SKETCH

Shewing the
View of

SALT WORKS

*that would suffer by the bundling
arrangements with the
Proposed measures
for preventing loss in
the*

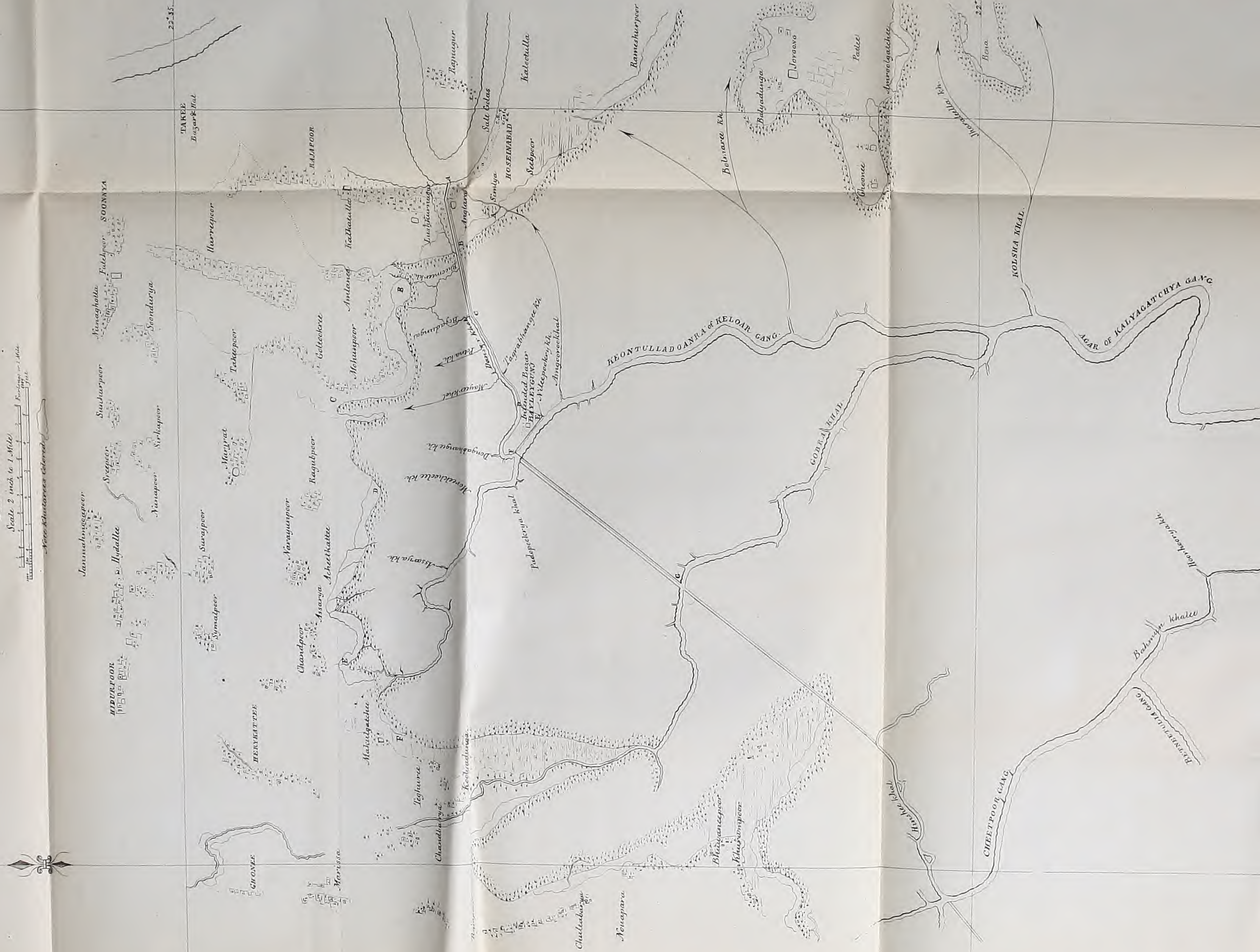
SALT MANUFACTURE

December 1823

Scale 2 inch to 1 Mile.



More Khutarees Colored





No. 24.

To CAPTAIN JACKSON,

*Assistant Quarter Master General, and
Secretary to the Canal Committee.*

SIR,

I have the honor of enclosing, in order that they may be forwarded to the proper authorities, a few remarks on the effect the opening of the Hosseinabad Canal will probably have on the manufacture of Salt in its vicinity. In these I have endeavored to shew, that if timely notice be given to the manufacturers, no loss will arise to Government, in the Salt Revenue, from opening the above-mentioned Canal.

I expect this Canal will be excavated during the present Dry Season, and as the advances are not made by the Salt Agent, before the middle of November, he will have full time to make such arrangements as may appear to him advisable.

As Lieut. Prinsep has surveyed the whole of the Salt lands in question, and is in consequence intimately acquainted with the subject of the enclosed remarks, which indeed are chiefly drawn from his information, the Committee may probably deem it advisable to recommend, that his services be called for by the Salt Agent, to assist in the arrangements that officer may think proper to suggest.

I have the honor to be, &c.,

CALCUTTA,

(Signed)

J. AUG. SCHALCH, *Captain,*

SUPT. OF CANALS' OFFICE.

12th Dec. 1823.

*Superintendent of Canals, and Agent for the
preparation of Suspension Bridges.*

No. 24. a.

Remarks on the effect the Canal between Hosseinabad and Bussera, will have, when opened, on the manufacture of Salt in its vicinity, and the cultivation of the adjacent land—intended to shew the obstruction that arises to the extension of the cultivation of Jungle tracts from the present situation of the Desea Khulories, and the advantages that would arise both to the cultivation of the country, and the manufacture of a better description of Salt, by their removal to the Southern side of the Canal.

During the period the plan, for the formation of the line of Canals at the head of the Sunderbunds, was under the consideration of a Committee of investigation, a petition* was presented to Government, by the Commissioner of the Sunderbunds, from certain landholders in the vicinity of Taky on the Juboona river, praying that Government would interfere to prevent the excavation of the Canal proposed to connect the Juboona River at Hosseinabad with the Choumooa Nullah at Bussera.

The petition arose from the fears of the inhabitants on the Juboona River, near the above-mentioned places, that, on opening the Canal, a body of Salt water would thereby enter the Juboona River, which it was apprehended, might not only render the adjacent country extremely unhealthy, but throw it into jungle, to an extent proportionable to the influence of the Salt water.

That these fears were not without foundation, was known to me at the time the plan of the Canals was given into Government. I had however provided a remedy against the apprehended dangers, which appeared quite satisfactory to the Committee.

* See Appendix to Appendix G. p. clxii.—J. M.

It will be seen by the accompanying map, that the line of the Canal is intersected by the Kelloah Gong at the bazar, which is now establishing on its Eastern bank, called Bayleygunge. A considerable body of water flows up this Nullah; the section at Bayleygunge being 230 feet broad, and 24 feet deep at high water. The tide also flows earlier in this Nullah than in the Juboona River, consequently, were the two connected, the water of the former would flow into the latter, and the danger above-mentioned would probably ensue.

I proposed therefore to close this Nullah on the Southern side of the Canal by a bund E.; by doing this, the tide from the Juboona will enter the Canal and will meet the tide from the Gobra Khal, left open to supply the Canal with water, when, the united streams will flow up the Bhagoria or Chandpoor Khal—on the recession of the tide, therefore, the water will flow from the Canal into the Juboona, impregnated perhaps in a slight degree with salt, from its union with the water of the Gobra Nullah; but not in a degree sufficient to affect so large a stream as the Juboona. Should this however be found to be the case, it will become necessary to bund the Gobra Khal in the same manner as the Kelloah Gong, and allow the Canal to be supplied from the Chitpore Gong, still further to the westward.

But in these endeavours to secure the country adjacent to the Juboona River near the line of the Canals, from the injurious effects of the admission of Salt water into that stream, it follows that the country on the Northern bank of the Canal, will, to a certain distance from the Juboona, be overflowed by Fresh water, and consequently such lands will be rendered unfit for the manufacture of Salt; an alarm is therefore spread among the Salt contractors, interested in the Khulories on the above lands, and they are on the eve of presenting a petition to the Salt Agent against the formation of the Canals, on grounds diametrically opposite to those on which the former petition was founded.

I shall endeavour however to shew, that the Canal so far from being detrimental to the Salt interest in this quarter, will offer facilities for its improvement; at the same time that the measure proposed will remove a chief obstacle to the cultivation of this, as indeed, of every part of the Sunderbunds, where the manufacture of Salt is conducted on the same principles.

An inspection of the accompanying map will shew, at once, the barrier that is formed against the extension of cultivation by the Salt Grounds, A. B. C. D. E. F., the difficulty of passing which, by the cultivator, arises from the following cause. In order to render the jungle lands fit for agricultural purposes, it is necessary after clearing them, to surround them with a bund to keep out the Salt water, which, during the spring tides, would otherwise overflow and cover the ground to a depth of from 8 inches to a foot. In forming these bunds it becomes also necessary to close up a number of small streams with which the Sunderbunds are in every part intersected. One of these streams probably supplies a Khulorie with Salt water; the consequence therefore of its being closed, is, that a complaint is immediately made to the local officers of the Salt Agent, the bund is destroyed, the labours of the cultivator are fruitless, and he relinquishes the land to return, in a few years, to its former state of jungle; although I cannot speak positively to the fact, I feel convinced, that many parts I have surveyed, which bore evident marks of having been once cultivated, have been again thrown into jungle from this cause.

Lieut. Prinsep, who has derived considerable information on the present subject during his survey of the boundary of the Sunderbund jungle and of the estates in its vicinity, assures me he has been witness to many cases in which the position of the Salt works has been an hinderance* to Talookdars, who were otherwise anxious to clear the jungle adjoining their estates for the purposes of cultivation.

* This, it is understood, has all been obviated by an order, that no Salt shall be manufactured *North* of the Attarra Banka, or Lower Soonderbun route, to prevent the smuggling which takes place near cultivated tracts.—J. M.

That the situation of this description of Khulories is unfavourable to the manufacture of the best kinds of Salt, is evident from the fact, that the Salt of the Desee Khulories bears an inferior price to what is manufactured lower down in the Sunderbunds.

Upon a mature consideration of the question therefore, I cannot but anticipate considerable advantages from the removal of the Khulories above-mentioned, to the Southern bank of the Canal; many of the disadvantages under which the Salt maker of these Khulories now suffers would disappear. He would, in the first instance, be on the banks of a Canal by which he would at times be supplied with food; the ground contains a greater quantity of saline matter, from not being inundated with Fresh water during the rainy season; and he will be nearer his supply of fuel, for it is an indisputable fact, that, although the Desee Khulories are on the verge of the jungle, wood, fit for boiling the Salt, cannot be procured at a less distance than 20 or 30 miles.

I do not apprehend that the Salt manufacturers will decline making Salt on the banks of the Canal. They will of course object at first to a removal, but if they are made to understand, before the advances are given them, the effect the Canal will have on their old Khulories, they will, it appears to me, willingly resort to the Canal; the occupation is too lucrative to be hastily abandoned, and they will in a short time become sensible of the advantages of their new situation. They would leave behind them no stock, the implements required in Salt making being no more than a small hoe to scrape the Salt earth from the surface of the ground, and a rude litter composed of Bamboos, to carry it to the place where the brine is to be extracted; and even the apparatus for extracting and boiling the brine, is a simple construction of mud and such shrubs as are procurable in every part of the Sunderbunds.

On the removal of the Khulories, the immediate cultivation of the country to the Northward of the Canal may be anticipated, which may extend even to the Southward of it, if the situation of the new Khulories be judiciously chosen.

(Signed) J. AUG. SCHALCH, *Captain,*
Superintendent of Canals.

CALCUTTA,
SUPERINTENDENT OF CANALS' OFFICE.
12th December, 1823.

No. 25.

No. 353.

TO CAPTAIN J. N. JACKSON,
Secretary to the Canal Committee.

Territorial Department. Salt.

SIR,

With reference to your letter of the 31st December, relative to the measures proposed by Captain Schalch, for opening the Canal between Hosseinabad and Busera, I am directed by the Right Honorable the Governor General in Council, to transmit to you the accompanying copies of a letter from the Board of Customs, Salt and Opium, and of its enclosure, from Mr. Barwell, together with copy of the letter this day addressed to them on the subject.

2. The Canal Committee will instruct Captain Schalch to cause the parcels of ground, specified by Mr. Barwell, to be cleared without delay.

3. The Original map which accompanied your letter, is herewith returned.

I am, &c.,

COUNCIL CHAMBER,
The 5th March, 1824.

(Signed) HOLT MACKENZIE,
Secretary to the Government.

No. 25. a.

TO THE RIGHT HONORABLE LORD AMHERST,

Governor General in Council.

§c. §c. §c.

Salt.

MY LORD,

With reference to Mr. Secretary Mackenzie's letter of the 17th ultimo, we have the honor to submit, for the information of Government, the accompanying report, dated the 12th instant, with the enclosures, from the Salt Agent of Jessore, relative to the measures proposed by Captain Schalch for preventing loss to the Salt manufacture, from opening the Canal, which is to connect the Juboona River at Hosseinabad with the Choumooa Nullah at Bussera.

2. The agent states, that by closing the Kelloah Gong at Ballygunge, to secure the Juboona from the admission into it of too great a body of the Salt water, the operation* of 152 Calaries, on the Northern bank of the projected Canal, will be destroyed; and that about 35 more will be rendered useless, in the event of the Gobrah Khaul being bunded—but he concurs in the opinion of the Superintendent of Canals, that all objections may be obviated by removing the Calaries to the Southern side of the Canal. Assistance, Mr. Barwell thinks, should be given towards clearing away the jungle for the reception of the Calaries, and to meet the expence of transferring their works, as well as the loss which he apprehends the manufacturers will suffer in the first instance; he suggests that one anna per maund should be paid, in addition to the existing rates, for the Salt made from the new Calaries, for one year after their establishment.

3. We have no doubt that Government will concur in the propriety of affording every aid to the parties in establishing the Calaries, and we would accordingly recommend, that Captain Schalch should be instructed to render this, and to cause the spots noticed in the 6th Paragraph of the Agent's letter (which seem to have been judiciously selected), to be cleared, at the public expence, for that purpose.

4. It does not occur to us, that it is either necessary or advisable to grant any enhancement of price for the Salt, since, even if there should be some deficiency in the produce at first, there can be no question, from the superior facilities secured to the manufacture, from the more abundant supply of fuel and Salt water, which will be available in the new lands, that the Calaries will ere long, be much more productive than they now are, and that an ample remuneration will be found in their improvement, for any trifling loss which may at first be incurred.

5. We beg to return the map transmitted with Mr. Mackenzie's Letter.

BOARD OF CUSTOMS,
SALT AND OPIUM,
The 16th February, 1824.

We have, &c.
(Signed) J. P. LARKINS.
H. SARGENT.

* All Salt works, it is stated, have since been removed to the South of the old Soondurbun route by the Attara Banka.—J. M.

No. 25. $a\frac{1}{2}$.

TO J. P. LARKINS,
 GEORGE CHESTER, } ESQUIRES.
 HENRY SARGENT, }

Board of Customs, Salt and Opium, Fort William.

GENTLEMEN,

I have the honor to acknowledge the receipt of your Secretary's letter of the 24th January last, with the several documents which accompanied it, directing me to furnish a communication of my sentiments on the measures proposed to be adopted by Captain Schalch, for guarding against any loss to the Salt manufacture, by opening the Canal at Hosseinabad.

2nd. The bunding of the Kelooagong Khall, would, by preventing the admission of Salt water to the Salt lands, destroy the operation of 152 Calaries, situated in Hoodahs Hosseinabad, Amlunee, and Myenadangh—and in the event of its being found necessary to shut up the Gobra Khall, the manufacture of about 35 more Calaries in Hoodah Hurricattee, would also be stopped.

3rd. The removal of these Calaries, however, to the South side of the Khall, will be extremely feasible, if some little assistance is afforded to the manufacturers; and I am inclined to concur in opinion with Captain Schalch, that eventually the Calaries would prove equally productive, if not more so, than the old ones. The resources for the manufacture, in an abundant supply of fuel and Salt water, would probably be more available, than where they are at present situated: the produce for the first two years, after their establishment, would probably be deficient, but after being worked for that time, there can be little doubt of their proving as productive, if not more so, than the old Calaries.

4th. The principal difficulty exists in clearing away the jungle from those places, where it is proposed to fix the Calaries, as the Sajeeneahs have not the means of meeting the expence, which such an operation would involve: I would beg therefore to propose, that Captain Schalch may be instructed to lend his assistance for this purpose, and that he may be furnished with instructions to that effect, at as early a period as practicable, as no time should be lost, in preparing the places for the Calaries, for the ensuing season.

5th. The removal of the Calaries to the South side of the Canal, admitting that the jungle is cleared for them, will probably subject the Sajeeneahs to some expence—for which one anna additional would be an equitable remuneration; and I would beg to recommend that the parties may receive 15 annas, for the first year, for every maund of Salt manufactured, in the new Calaries.

6th. The high ground at Chalkoonnee, a place to the Southward of the Canal, might, if about 200 Beegahs of jungle were cleared by Captain Schalch's people, afford space for 90 or 100 Calaries—another spot situated between Hosseinabad and the Dansare Khall, South of the Canal, would hold 8—and there are waste lands at Hosseinabad and a place called Koolyadangah, which might, I understand, contain 40 or 50 more, making nearly the number that would be destroyed by shutting up the Kuboorgong [? Kulloar] Khall.

7th. The documents, which accompanied your Secretary's letter of the 24th of January, are herewith returned, and I beg leave to forward, at the same time, a copy and translation of a Derkhaust presented to me by the people concerned, for your information and instructions.

I have, &c.

(Signed)

R. C. BARWELL,

Agent, Salt Department.

JESSORE SALT OFFICE,
 The 12th February, 1824.

APP. H.

N 11

No. 25. b.

No. 352.

To BOARD OF CUSTOMS, SALT AND OPIUM.

Territorial Department. Salt.

GENTLEMEN,

I am directed, by the Right Honorable the Governor General in Council, to acknowledge the receipt of your letter of the 16th ultimo, with the several papers mentioned to accompany it, relative to the measures proposed by Captain Schalch for opening the Canal between Hosseinabad and Bussera.

2nd. On a consideration of these papers, His Lordship in Council is satisfied, that the temporary and partial inconvenience likely to result, from the closing of the Kellooah Gong, and as eventually proposed, of the Gobrah Khall, is not of sufficient moment to cause any hesitation in the execution of these works, if found necessary, for the purposes explained by Captain Schalch.

3rd. It is obviously desirable to avoid any increase of price, which it will not probably be easy to reduce after the cause has ceased. It seems however, to be quite proper that, as suggested by your Board, the occupants of the Kalaries, which will have to be deserted, should be assisted, in establishing new ones to the South of the Canal.

4th. Captain Schalch will accordingly be directed to cause the parcels of ground, specified by Mr. Barwell, to be cleared without delay.

5th. The Original Papers, which accompanied your letter, are herewith returned, copy of Mr. Barwell's letter being kept for record.

I have the honor to be, &c.

(Signed) HOLT MACKENZIE,
Secretary to the Government.

COUNCIL CHAMBER,
The 5th March, 1824.

* See No. 38. No. 38. a, and No. 39. of this Appendix page — J. M.

*No. 34.

(No. 501.)

To W. MONEY,
H. SHAKESPEAR,
AND
C. R. BARWELL, } ESQUIRES,

Canal Committee.

Territorial Department. Revenue.

GENTLEMEN,

I am directed by the Right Honorable the Governor General in Council, to transmit to you for report, the annexed copy of a letter from Mr. J. Jessop, dated the 9th instant, together with the paper mentioned to accompany it.

2nd. The immediate question is, how far Railways could be expediently substituted for any of the contemplated Canals, or otherwise be usefully introduced in this country. Mr. Jessop will probably be able to furnish you with more detailed information than is contained in these papers.

I am, &c.

(Signed) HOLT MACKENZIE.
Secretary to the Government.

COUNCIL CHAMBER,
The 19th May, 1825.

No. 34. a.

(Copy.)

HOLT MACKENZIE, ESQ.

Secretary to the Government.

Territorial Department.

SIR,

I beg leave to enclose a report received from England, and would take the liberty to request you to peruse the same at your leisure. My object in thus addressing you is, to ascertain how far the Government may deem it expedient to adopt in this country the use of Railroads, with Locomotive Engines.

In suggesting a line of Railroads from Calcutta to Diamond Harbour, in lieu of the proposed Canal, I feel convinced that it would be a great saving to the Government, both in the formation and subsequent conveyance of goods.

In this assertion, I am supported by the enclosed report, and moreover, from the nature of the soil in this country, the cost of Puddling would render the difference of the expence, between cutting a Canal and laying a Railroad, even greater than is shewn in the report.

The explanation given in the enclosed is so satisfactory, that I deem it unnecessary to say anything further. I shall be happy to answer any enquiries the Government may please to make, and, if required, will undertake the survey of the road, and furnish an estimate accordingly.

I am, &c.

CLIVE STREET,
The 9th May, 1825.

(Signed) GEO. JESSOP,
(A true Copy.)

The 19th May, 1825.

(Signed) HOLT MACKENZIE,
Secretary to the Government.

No. 34. a.⁽¹⁾

TO THE COMMITTEE OF THE PROPOSED RAILWAY FROM CROMFORD
TO THE PEAK FOREST CANAL AT WHALEY BRIDGE.

GENTLEMEN,

Having completed the survey of the proposed Railway from Cromford to the Peak Forest Canal at Whaley, and prepared the plans necessary to enable you to proceed to Parliament in the next session ; I now submit to you the estimate for a double line, formed from accurate admeasurements, of which the particulars are detailed in the accompanying paper, and the following is an abstract :—

	£.	s.	d.
Common Forming,	2,319	19	0
Cutting and Banking,	17,015	10	8
Face-wallings to Embankments, .. .	1,175	17	0
Bridges and Culverts,	1,633	10	0
Tunnel at Burbage,	5,700	0	0
Sloping,	7,656	0	0
Fencing,	6,400	0	0
Cast Iron Rails,	61,950	0	0
Blocks, Nails and laying down, .. .	5,810	0	0
Land,	4,800	0	0
Houses and Compensations,	1,000	0	0
Wharfs and Warehouses,	2,000	0	0
Contingencies, at 10 per cent. .. .	11,746	0	0
	£129,206	16	8
Steam Engines, &c., for the inclined planes, .. .	20,000	0	0
	£149,206	16	8

Although I have made considerable allowance for the advance on iron and the probable rise of labour, yet the estimate does not exceed the sum originally stated as the probable expence.

In the direction of the Railway, I have not seen reason to make any material alteration from the course described in my former report, but to avoid the necessity of tunnelling through the high ground near Haven Lodge, I have made the Railway ascend an eleventh of an inch in a yard, after passing the embankment near Pike Wall, and continued that ascent for $3\frac{1}{2}$ miles, which leaves a deep cutting of 24 feet at the brow of the hill; this slight rise will not be attended by any inconvenience, as its obstruction to carriages will not be greater than is caused by the curves of the Railway; it will only require the precaution of laying the curves in this part perfectly level.

As the general opinion of Railways have been formed from those of long standing and imperfect construction, no public one on the new system being yet completed, their effect and advantage are probably much underrated, and it may be necessary that I should notice the improvement which has so greatly extended their utility, and given them so decided an advantage over all known modes of conveyance for expedition and economy combined with safety.

Every one is aware of the immense advantages that have accrued to this kingdom from the introduction of Steam Engines to our mines and manufactures, which, by giving cheapness and facility to labour, and by enabling one man to direct the power which performs the work of hundreds, has raised the country to its present distinguished pre-eminence; had any one ventured to predict it forty years ago, when these changes were in their infancy, there would have been some reason to disbelieve that so important an effect could be produced by a cause apparently so inadequate; but with the experience of the past, there can scarcely be a doubt, that these advantages will extend to our modes of conveyance, as it is only an application of the same principle, the substitution of a cheap and powerful mode of performing labour, in place of a more expensive one.

The mode of conveyance that most nearly assimilates to Railways, is Canals; but to them, the agency of steam cannot be available, as they are limited to the size of their loads and as regards utility, to the speed of conveyance; for to draw a load of 40 or 50 Tons with double the speed that is now done by one horse, could not be effected on a common Canal by any power, that can be applied.

The comparatively small expence of forming Railways, will be a cause of extending our resources and finding new channels for capital and industry, and would for ever have been neglected, if there were on the more expensive modes of Roads or Canals to resort to; the first being expensive in the carriage, the latter in the execution. But a Railway can, according to circumstances, be made at from a half to a fourth of the expence of a Canal,* and convey goods more cheaply, which would render them lucrative, when any other mode would be ruinous.

The old system of forming Railways, was to make them with a regular inclination, adapted to the natural declivity of the country through which they passed, so that a horse had to perform the labour of ascending, as well as [to] overcome the friction of the carriages (for beyond a very small rise a locomotive engine will not work to advantage); the improvement has been to separate, as far as possible, the mechanical power from the friction, concentrating the power at fixed points, where by means of stationary Steam engines applied to inclined planes, the ascents are overcome at once, leaving only the friction and the distance to be done by the Horse or the Locomotive Engines. A Railway on this system is therefore equally suited to a mountainous or a level country, and either Horses or Locomotive Engines may be

* A Canal to form the same connection as is proposed by the Railway, was estimated in October, 1810, by the late Mr. Rennie, to cost £650,000.

used upon it, (though not both with advantage at the same time, from their difference of velocity,) the waggons being drawn along by the Locomotive Engine, which derives its motion from contact and friction of the wheels against the rails, the wheels being attached directly to the Steam Engine.

Where a Railway is level, the power required to move the waggons is little more than the friction, which is found to amount to about a two-hundredth part of the weight to be conveyed ; or in other words, a power of one pound applied in the direction of the motion, will draw forward 200 lbs. ; but as this supposes all parts of a Railway to be equally perfect, it is right in practice not to calculate on more than 150 lbs.

The power to which a Locomotive Engine can be worked on a level Railway, by the friction of the wheels against the rails, before the wheels slide, or revolve, without advancing, varies under the circumstances of the weather ; when the rails are wet, the friction is equal to 4-32 parts of the weight, and when dry 5-32 ; but practically a tenth part of the weight only should be calculated on, as the effective power. A Locomotive Engine of 10 horse power, will draw 120 Tons at the rate a draught horse generally travels, or 50 Tons at the rate of 6 miles in an hour. The engine requires the attendance of only a man and a boy, at a daily expense of 5s. : the Coals consumed in 10 hours, would be from 20 to 30 Cwt. ;—therefore the expense altogether, would be less than 30s. per day, for which 50 Tons may be conveyed 60 miles in 10 hours, which is less than half a farthing per Ton, per mile : so that making ample allowance for delays, the return of the empty carriages, the cost and maintenance of the engines, and providing the waggons, the expenses are altogether inconsiderable. I may here remark, that the rate of travelling may be increased to surpass that of mail coaches, and that the Locomotive Engine will, as readily, convey 25 Tons (including its own weight) at the rate of 12 miles an hour, as double the weight, in twice the time.

It is more than 20 years since the Locomotive Engine, worked simply by the friction of its wheels, was used upon the Myrthyr Tydvil Railway in South Wales, but owing to the Railway being made on the old principal with a declivity, it had not the advantage that was expected. Its next application, was on the Railway from Mr. Brandling's collieries, near Leeds, where a cogged wheel worked into cogs upon the side of the Railway to propel the waggons ; but in this instance the advantage was inconsiderable, from the same cause,—the ascent of the Railway. It was then introduced among the Newcastle collieries, and observation soon pointed out that it was most effective, as the Railway approached to a level, where ascents or descents were unavoidable : they were obviated by the introduction of inclined planes, up which the loaded waggons were drawn by stationary engines, or the loaded waggons descending, drew up the returning empty ones ; their present degree of perfection has thus been gradually attained, and four or five years' experience, has fully proved their simplicity, cheapness, and regularity.

On the proposed Railway, where the ascents from Cromford, by four inclined planes, is nearly 1,000 feet, and the descent to the Peak Forest Canal, between 700 and 800 feet, by three others ; the average cost of working each plane, will be about a half-penny per Ton.

When these very moderate expenses of carriage are considered, it furnishes an additional argument, in favour of the opinion I expressed in my former Report,—that a Railway, forming so important a connection between rich and populous districts, and with Canals which yield an abundant revenue, cannot be a speculation of hazard, but must be a secure and a lucrative mode of investing Capital.

I have, &c.

(Signed) JESIAS JESSOP.

BUTTERLEY HALL,
November 29th, 1824.

No. 56½.

No. 97.

To LIEUTENANT T. PRINSEP,

Superintendent of Canals.

SIR,

* See No. 56. b. and No. 56. b. (1) at pages 65 to 67, inclusive, of this Appendix—J. M.

I am directed by the Canal Committee, to acknowledge the receipt of your letter of the 20th of November, forwarding a Report* on the state of the Ballia Ghaut and Entally Canals, together with an estimate of the probable cost of excavating the same, to the depth of four (4) feet and re-sloping its banks.

2. As the Committee cannot take upon themselves to purchase the lands, required to afford you additional breadth for re-sloping the banks, without a reference to Government, I am instructed to acquaint you, that a copy of your Report and Estimate, have been submitted for the consideration and orders of the Right Honorable the Vice-President in Council; in the meantime, however, with a view to avoid delay at this season, in advancing the progress of the work, the Committee authorize your making out receipts, for the Collector of the 24-Pergunnahs, for the sum of Sa. Rs. 1,000 (one thousand,) to be paid from the balance in his hands, of Sa. Rs. 3,785, for the purpose of clearing and deepening the Entally Canal.

3. This sum, the Committee apprehend, will be sufficient to enable you to commence excavating by sections, in the manner proposed by you; and until a reply can be received from Government, to the reference made to them.

CANAL COMMITTEE'S OFFICE,

CALCUTTA,

5th December, 1826.

I have, &c.

(Signed) J. N. JACKSON,

Secretary, Canal Committee.

No. 64.

No. 17.

To CAPTAIN J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

Since my last communication with the Committee, I have, in anticipation of the sanction of Government to the General Scheme of Operations, sanctioned in their Order of 19th October 1826, made a particular survey, of the most judicious course to be given to the Chultabarya Canal, which I have accordingly staked out and divided into lots for contract. I have the honour to enclose a sketch of the spot, from which the Committee will perceive, that the length of excavation required, will exceed my supposed length of $1\frac{1}{2}$ mile, being 11,700 feet, in consequence of my rejecting the part of the old Bungur Nullah, west of the dam at A to D. This Nullah appears to have filled up considerably since its survey by Major Schalch, from its being annually dammed up in 3 places, during 3 months. The small Nullah originating at B, below Chultabarya, is too inconsiderable to be of any advantage. The Tarda Bidyadhuree, which is likewise dammed up above and below Chultabarya, appears to be daily losing its depth of water, and I apprehend; that the portion of it required for our Canal of communication with the Lake, will require something, to make it sufficient for the purposes of navigation.

SURVEY
along the
Course of the
BUNGUR KHAL

/Signed/ *Thos. Prinsep Lt. Eng^r*
16th Jan^y 1827.



from A to B required to excavate to average depth of 14 feet
" A to C " Clearing, embankment, and deepening.

Upon this portion of my scheme, I shall therefore, necessarily, much exceed my estimate of 15,000 Rupees; as, however, I expect to expend much less than my estimate upon another part, viz.—the Kullooar Dam, and opening of the Hossenabad cut, which depends upon its execution, the aggregate amount of yearly expenditure is still likely to be, as estimated, within 50,000;* a further reference to Government on the subject, will therefore scarce be necessary.

* In my Estimate and the report No. 134, accompanying it, an error was made of 10,000, in the addition—for 32,707: 8, read 42,707: 8—and for 40,000 in paragraph 3, read 50,000.

With regard to the Kullooar Dam, I fear the season has too far advanced, to allow of its being carried into execution with any economy, or even stability. The salt tides are too powerful, from January to May. The season for its execution is October, November and December, when the tides, to my knowledge, are slack in all Sunderbund Nullahs, not immediately connected with fresh water rivers. Some money must be expended in making necessary preparations, the completion, however, must, I fear, be deferred till next November.

4th. I have the honor to suggest to the Committee, the propriety of apprising the Collector of 24 Pergunnahs, of my having marked out the ground of the Chultabarya Canal, in order that the same may be officially measured and appraised by an ameen, deputed for the purpose.

I have likewise the honor to forward two receipts in duplicate, upon the Collector of Calcutta for 5,000 Rupees each, upon the assignment No. 51 of 1826-27, now in the hands of the Committee: that no delay may occur in giving the advances for Mufussil operation, I have to request, the earliest period for its counter-signature.

I have, &c.

CALCUTTA,
SUPERINTENDENT CANAL'S OFFICE.
20th January, 1827.

(Signed) THOS. PRINSEP, *Lt. Eng-
Superintendent of Canals.*
(True Copy.) J. N. JACKSON.

No. 68.

No. 22.

To H. T. PRINSEP, ESQ.

Acting Secretary to Government.

SIR,

I have the honor, by desire of the Canal Committee, to submit for the information of the Right Honorable the Vice-President in Council, the annexed copy of a letter⁽¹⁾ and of its enclosure, dated the 19th instant, from the Board of Revenue, being in reply to a reference made by the Committee, in conformity with the instructions of Government of the 29th ultimo,⁽²⁾ on the subject of the quantity of ground, originally purchased by Government, on account of the Balliaghaut and Entally Canal and Roadways.

(1) (2) See pages 70 and 71 inclusive, of this Appendix No. 63, and No. 63 a.—J. M.

By the Board's letter, it would appear that, in addition to the quantity of ground obtained for the Canal; itself being 90 feet in breadth, a further space of 30 feet on each side had been purchased and assigned for Roadways, which will admit of a sacrifice to the extent deemed necessary by Lieutenant Prinsep, for widening and re-sloping the banks of the Canal of about 8 feet on each side. The Committee, with reference to paragraphs 2nd and 3rd of their letters of the 2d ultimo,⁽³⁾ would again recommend to the particular attention of Government, the plan proposed by Lieutenant Prinsep, and submitted with my letter above alluded to.

(3) See No. 5.

I have, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA,
29th January, 1827.

(Signed) J. N. JACKSON,
Secretary Canal Committee.

No. 69.

No. 280.

To MAJOR JACKSON,

Secretary to the Canal Committee.

Territorial Department. Revenue.

SIR,

I am directed by the Right Honorable the Vice-President in Council, to acknowledge the receipt of your letter, dated the 29th ultimo, with its enclosures, relative to the Plan suggested by Lieutenant Prinsep for widening the Balliaghaut and Entally Canal.

2d. His Lordship in Council remarks,—that the Plan has been already approved, and the expense sanctioned,* with the reservation of the amount estimated as the price of further ground on either side—which, from your present letter, seems not to be required: under these circumstances, no delay need occur in executing the improvements proposed by the Superintendent of Canals.

* See No. 59—
J. M.

COUNCIL CHAMBER,
The 8th February, 1827.

I have, &c.
(Signed) H. T. PRINSEP,
Acting Secretary to the Government.

No. 70.

No. 281.

To MAJOR JACKSON,

Secretary to the Canal Committee.

Territorial Department. Revenue.

SIR,

I am directed to acknowledge the receipt of your letter, dated the 29th ultimo, with the report⁽¹⁾ and sketch, submitted by the Superintendent of Canals, on the subject of the Chultabarya Canal, and to request that you will inform the Committee, that the Vice-President in Council approves the plan on which it is now proposed to execute that Canal, in modification of that sanctioned on the 29th December⁽²⁾ [? January] last, and authorizes the appropriation of a portion of the expense, sanctioned for completing the unfinished cuts from Hooseinabad with the Kullooar dam, to the purposes of the Chultabarya Canal, as suggested by Lieutenant Prinsep.

(1) See page 144,
of this App. No.
64—J. M.

(2) No. 70, of
Index to Appen-
dix (H)—J. M.

COUNCIL CHAMBER,
The 8th February, 1827.

I am, &c.
(Signed) H. T. PRINSEP,
Acting Secretary to the Government.

The map shows the Godavari river flowing from the top left towards the bottom right. Along the left bank of the river, there is a row of small rectangular buildings labeled 'The House of Boba De Regorio'. Further down the river, a larger area is labeled 'WOOD'. To the right of the wood, a large area is labeled 'the COMPANY'S Property'. This area contains numerous small rectangular buildings. A road or path runs along the right bank of the river, with several buildings labeled 'Rajahmundry'. At the bottom of the map, a bridge is labeled 'M. D. Bridge'. To the right of the bridge, a building is labeled 'M. D. Bazar'. The map is oriented with North at the top.

of the.

*Exhibiting the various Properties which
adjoin the road on its banks*

Measured in mm

Feb^y 1827.

617

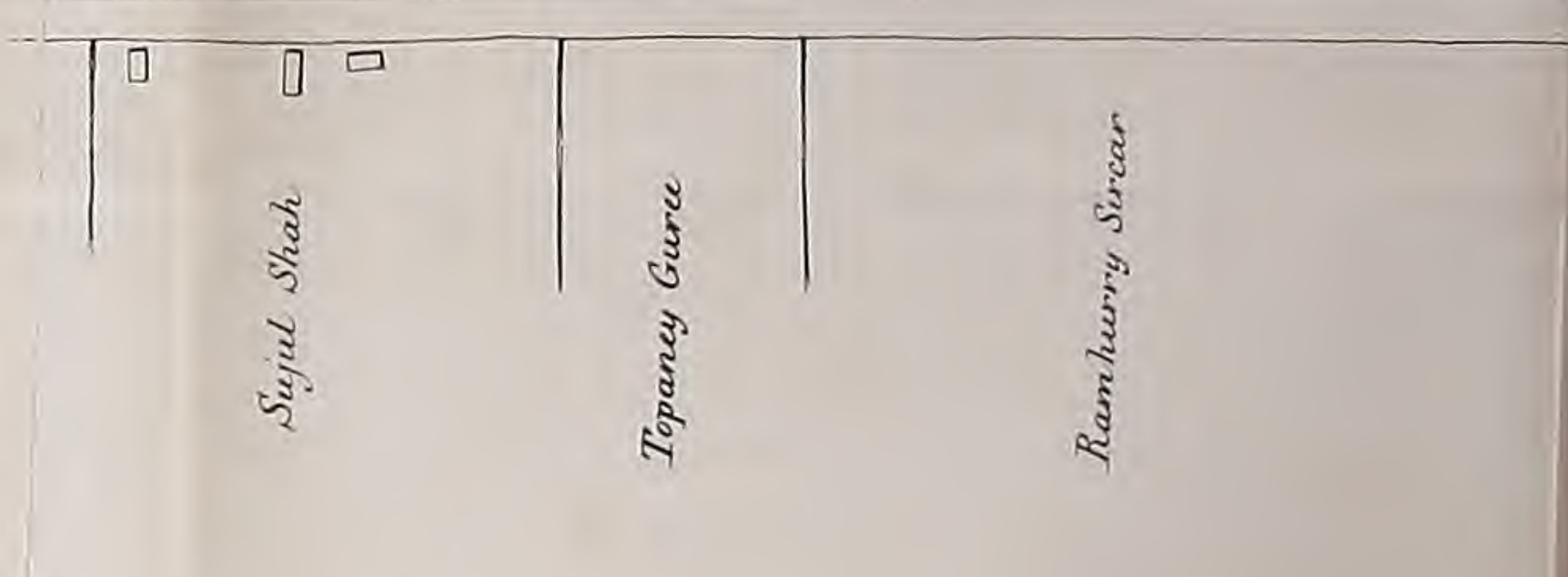
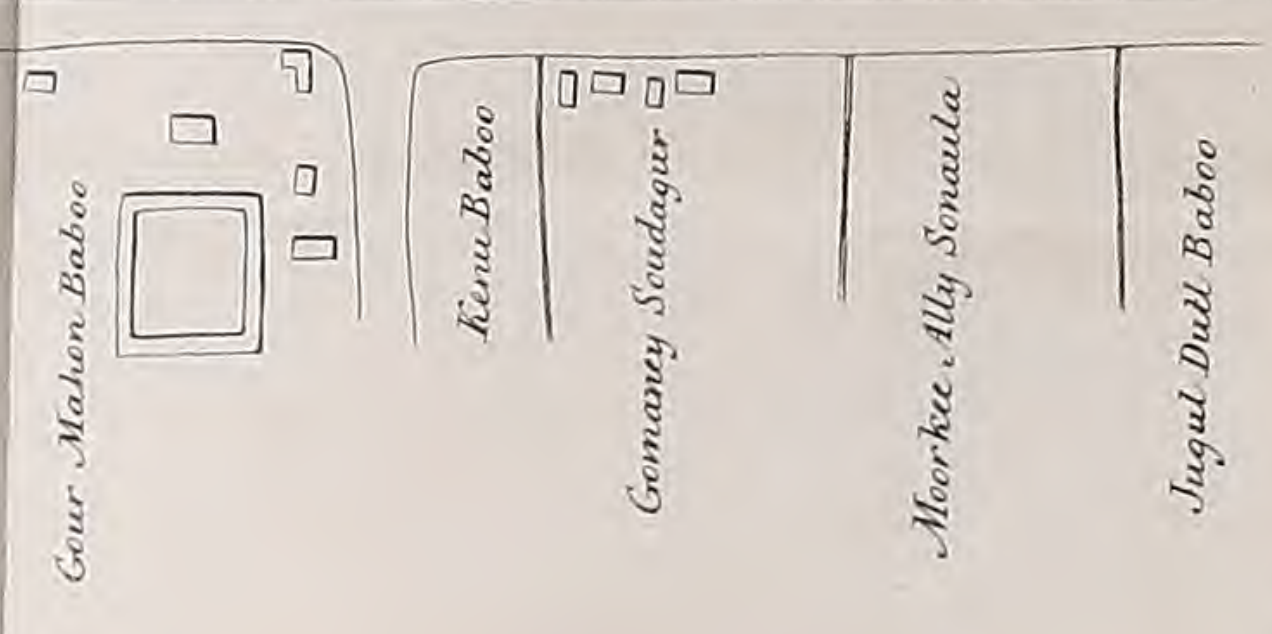
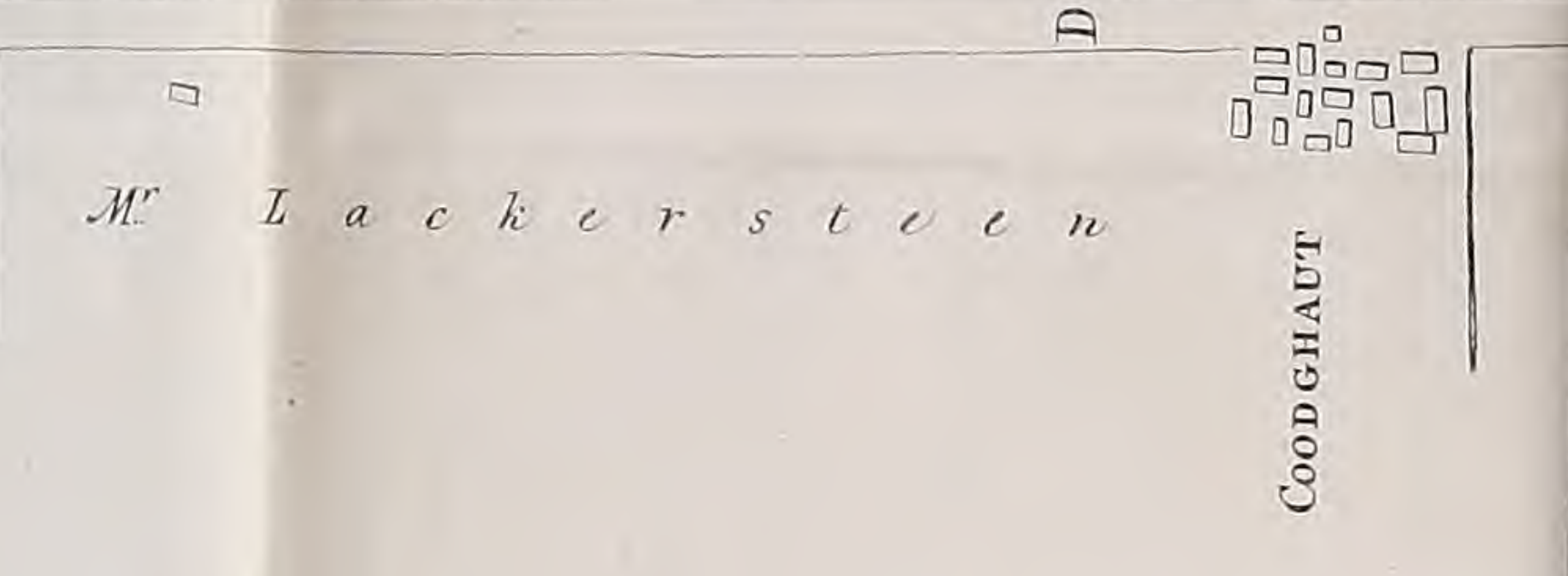
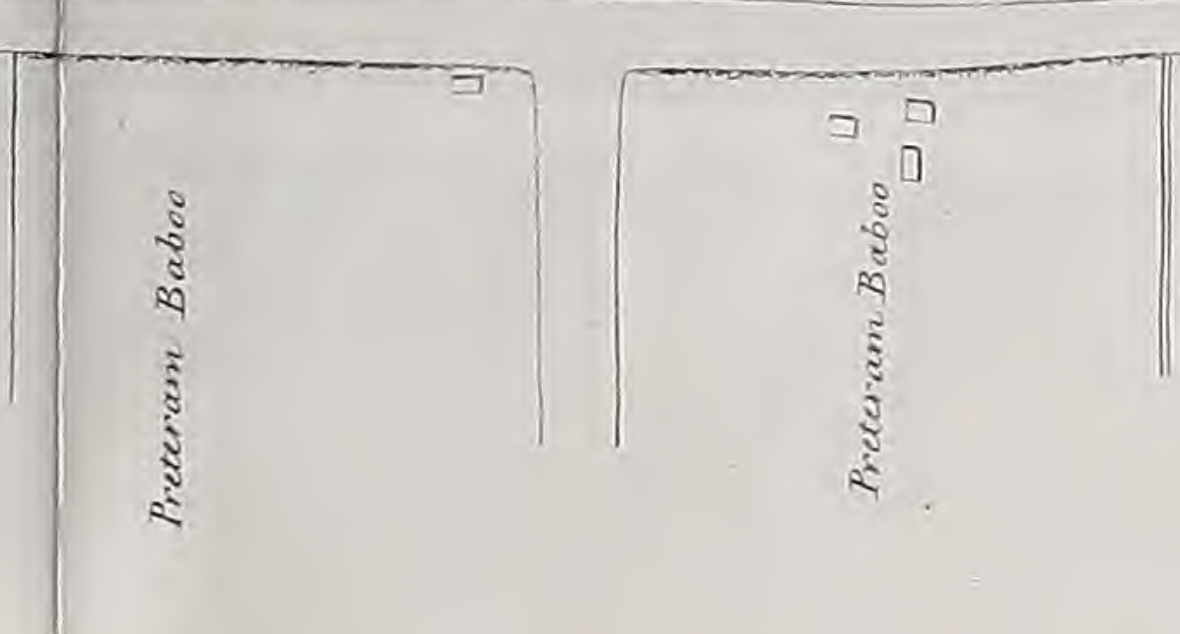
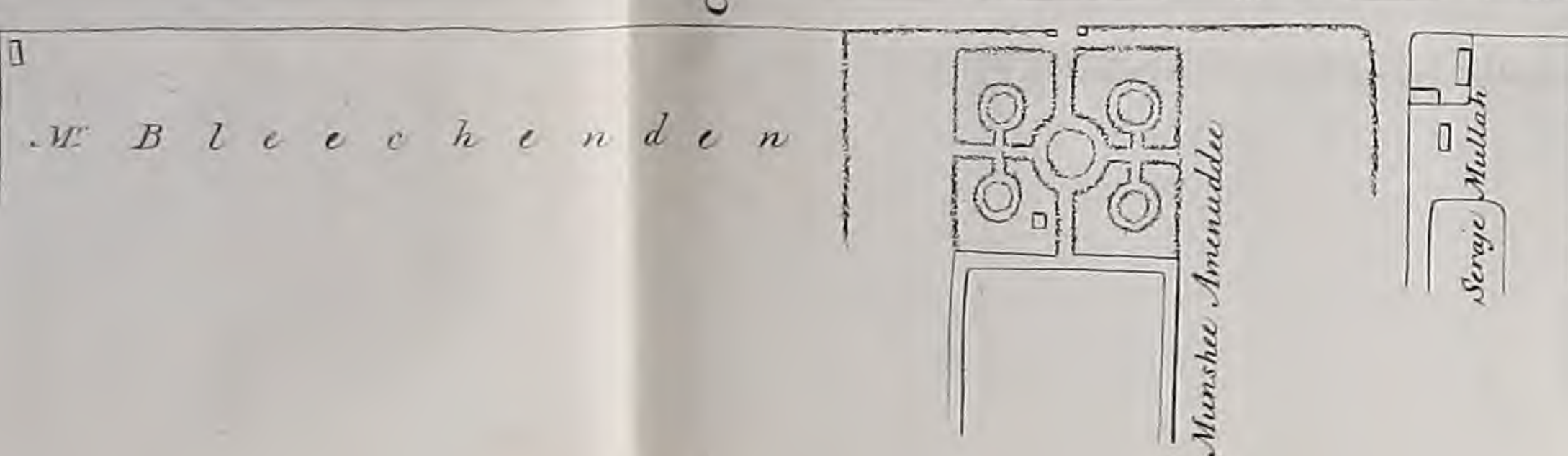
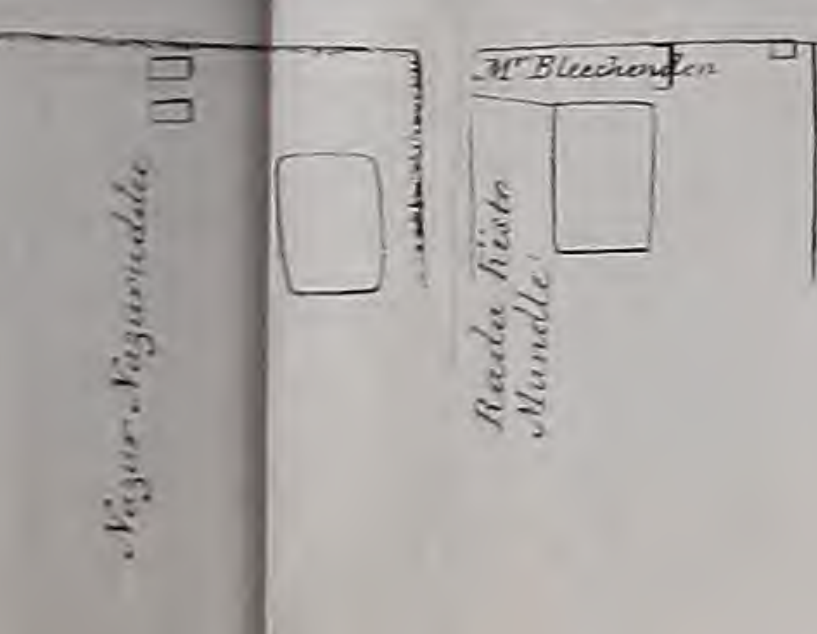
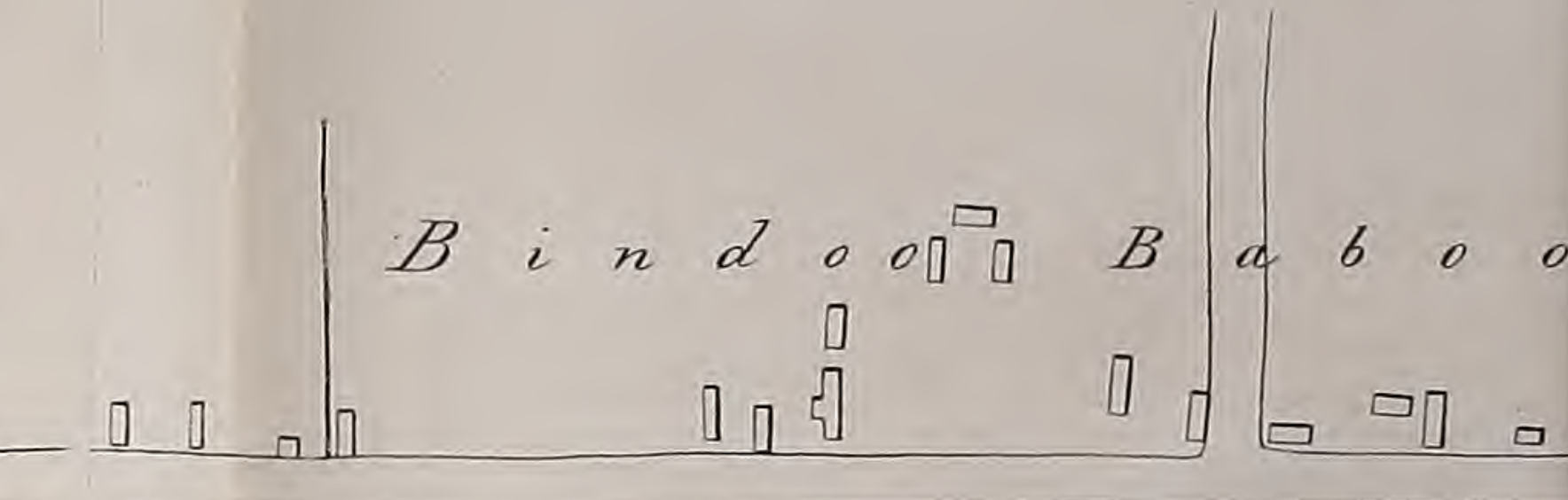
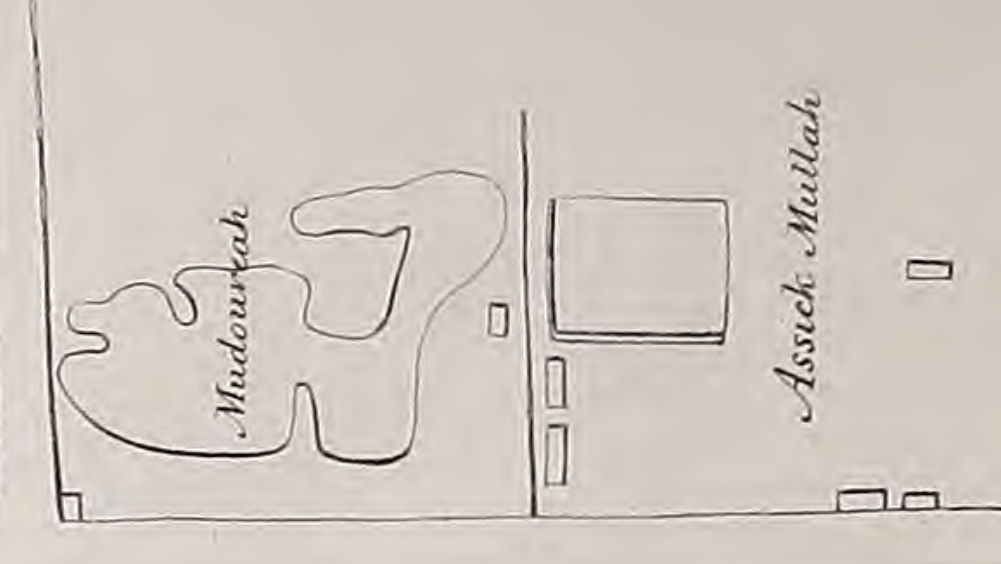
H. Turner

Wm. Princeps Divul. & Eng.
Supt. Canals





2/11/17



Sahaboo Chandra

Addo Goldar

Ramhurry Sircar

Turak Money

Thanchan Paul

Ramnaraia Ghose

K i s s e n k a u n t h s e n

Petamber Ghose

Ramhurry Sircar

Mandaram Mundle

Ramhurry Sircar

M. Myres

Ramhurry Sircar

Munshi Hussain Ally

Bularam Sett

Anunder Ram Mundle

Bularam Sett

Gibbels

K i s s e n k a u n t h s e n

FISH
BAZAR

A L I

No. 71 $\frac{1}{2}$.

No. 32.

To LIEUT. T. PRINSEP,

Superintendent of Canals.

SIR,

In continuation of my letter No. 97 of the 5th December last, relative to the measures proposed by you for widening and deepening the Ballia Ghaut and Entally Canal, I have now the honor, by desire of the Canal Committee, to transmit for your information and guidance, the annexed copy of a letter⁽¹⁾ and of its enclosure from the Board of Revenue, dated the 19th January, and with advertence thereto, and to the plan proposed by you in paras. 2d, 4th, and 8th of your Report⁽²⁾ of the 20th November last, I am directed to inform you that, the Correspondence which has passed on this subject having been laid⁽³⁾ before the Right Hon'ble the Vice-President in Council, His Lordship has been pleased to sanction [the] immediate execution of the work in the manner suggested by you in the Report above alluded to.

(1) Printed as No. 63 and 63 a, in this Appendix at page 70.—J. M.
(2) See No. 56 b, of this Appendix page 65.—J. M.
(3) See No. 56 of Index to App. (H) and No. 68 of App. H, page 145.

I have, &c.

(Signed)

J. N. JACKSON,

Secretary Canal Committee.

CANAL COMMITTEE'S OFFICE,

CALCUTTA,

19th February, 1827.

No. 72.

No. 36.

To MAJOR J. N. JACKSON, A. Q. A. G.

Secretary to the Canal Committee.

SIR,

With reference to the orders contained in your letter⁽¹⁾ No. 32 of 19th February, I have the honor to inform the Committee, that having now prepared with the assistance of Private Turner, an accurately detailed Survey⁽²⁾ of the Eastern Canal, showing the existing boundaries of the several properties adjoining, I am able to offer more matured propositions regarding it, and likewise to state with certainty, where any encroachment has been made upon the original 150 feet in breadth, purchased by Mr. J. Shakespear, in 1807-8.

(1) See No. 71 $\frac{1}{2}$ of this Appendix.

(2) The Survey in original, is lodged in the office of the Military Board.—J. M.

The general breadth of the Canal and Roadways at present exceeds 150 feet, and the encroachments in, as far as I can trace them, have been very inconsiderable in amount—less than one bigga, as seen in the enclosed list. It is still uncertain, whether the want of breadth in these places proceeds from such cause, as in so many other places it exceeds 150 feet.

The orders of the Committee, appear to have been written with the impression, that, upon survey, it would be in our power to recover 30 feet on each bank, for the purpose of a road. In many parts of the Canal where there is still 30 feet of roadway, the slope is so steep, that for security against its mouldering into the bed of the Nullah, it is necessary to sacrifice, in some places, 10 to 15 feet agreeably to my former proposition for scraping it to a slope of double its height. There are many parts of the road where the slope is very steep,

and the breadth of roadway scarce 20 feet. From the Coolya Bridge, westward, along the south bank, the road exists only as far as Mr. Williams' property, beyond which, there is scarce a pathway; the whole of the bank along this part is steep.

The chief object in giving a good slope to the bank, is to prevent the mouldering of its surface, falling into the still water of the Nullah, from filling up the Channel, and by this means, obviating one of the causes of the constant obstructions to the navigation. The principal steep parts are on the south bank from the bridge west, where there is no road from the point A to B, where the road has only 17 to 24 feet breadth, and C to D, where the road has 30 feet mean. I am at present engaged in scraping the latter division, and shall have a road average 22, at the narrowest 12 feet.

The principal thoroughfare, and all the principal Bazars and store Godowns, are on the north bank, and I should consider 20 to 24 feet, quite sufficient breadth for the roadway on the south bank, and that it is not absolutely necessary at present to open, by purchase, the road from the bridge west, in as much as there are no Godowns in this part, and the thoroughfare is not indispensable to the traffic. In the second division from A to B, the breadth of the present roadway is too narrow, to allow me to cut away any part of it for a good slope, and if such is ordered by the Committee, purchases to the average of 10 feet in width will be necessary, as per account enclosed.

Before however, I urge the Committee to recommend such a measure, I am induced to bring to their notice, one that appears to offer more immediate advantage and utility, and although, perhaps, it is not legitimately an object for the funds of the Canal Department, it appears to be most essential to the perfection of the Canal under their Superintendence.

Nearly the whole landing of goods and cartage of the trade, appears to be confined to the north bank, on which the great body of Godowns are built—on the opening of the new Canal, the Godowns, from its* disembogement eastward, will be glad to remove to the ground which will be offered for sale or rent, on the west bank of the new Canal, between its mouth and the Balyaghaut road, after which, the great thoroughfare will be confined to the part between the junction of the new Canal and the Dhurumtolla.

During the progress of the present operations, the want of tenacity in the soil, has appeared to me so evident, that I am greatly apprehensive the turfing will not be sufficient to preserve it from decay, and in fact, along this part of the Canal, where the landing of lime, rice, and firewood, is so constantly carried on, the turfing would be of no use, in as much as vegetation will not thrive. The present road along this part is almost impassable in any season, quite so during [the] rains; and as the whole washing of this road, have hitherto, fallen into the Canal, I should say, that more *silt* has been accumulated from this, than from all other parts of the Canal. A pukka road sloped towards a 2 feet drain,† carried along its land side, with proper arched exits below the road, where there do not exist any exits for the purpose, would effectually remedy this—and likewise save any farther attention to the slope, and is so obviously beneficial a measure in every respect, that I am induced to forward an estimate* of the expense that would attend its construction.

At the same time I have to remark, that in case the measure is not approved, the present state of the road will make it absolutely necessary to do something, and that as a cutcha road with its slope, will require a greater breadth, the expense of purchasing ground will exceed that for one of pukka, I have added to the length of road, that of the road through the great firewood bazar, 800 feet in length, and 200 feet to communicate the end of the road with the pukka road at Mowlaally Durga.—The total length is thus 6150.

In my operations upon the Eastern Canal, I have found myself able to extend the excavating of the additional depth of 4 feet to a distance of 2000 feet beyond my estimated length, and where I then supposed from the very slimy nature of the bed, that dredging only was practicable, I shall therefore exceed my estimate upon this item. The difference

* Sic original.—
J. M.

† See Nos. 175 a. (1)
176, 183, 183 a.
and 184, of App. to
App. H.

* See No. 72 c.

will, I believe, be made up by the work upon the slope, which cannot be done with the present limited breadth of road, and the total amount remain the same as the original estimate.

I forward enclosed, besides the Estimate for 6150 feet of pukka road, an account No. 1, of apparent encroachment upon the Company's property—an account No. 2* of the ground required to be purchased to give a breadth to the two divisions A to B, and C to D, of the road on the south bank. I have not forwarded any account of what would be required on the south bank from the bridge westward to open the road A; I consider it not immediately necessary.

* See No. 72 a. and No. 72 c. of this Appendix.—J. M.

I have, &c.
(Signed) THOS. PRINSEP, Lt. Eng.
Superintendent of Canals.

CALCUTTA,
SUPERINTENDENT CANAL'S OFFICE,
19th March, 1827.

No. 72. a.

No. 1.

A List of encroachments† that appear from the present breadth to have been made upon the Honorable Company's land along the banks of the Ballia Ghaut and Entally Canals, South bank.

† See No. 191, of App. to App. H.—J. M.

West of Koolya Bridge,	Length	Breadth.
Mr. Markage, (20 feet of west end,) ..	$280 \times \frac{20}{2} =$	2800
Capt. Burke, 10 feet,	$240 \times 10 =$	2400
Noorden Durjee, unknown—bounds being un- defined and their being no Pathway at all. }		
Gonsalves,	$150 \times 10 =$	1500
Beebee Shaw, east corner, 10 feet, .. .	$118 \times \frac{10}{2} =$	590
Property opposite Beebee Jan, where 60 feet was purchased, 40 remains,	$170 \times 20 =$	3400
		— 10,690

East of Bridge.

Ramut Mistry, a pukka Godown,	$140 \times 6 =$	840
A Mosque on Dr. Henry's ground, apparently built on excavation earth,	$200 \times 10 =$	2000
		— 2,840
		— — —
		13,530

Biggas. Cottahs. Chittacks.

„ 18 $12\frac{3}{2}$

(Signed) THOMAS PRINSEP, Lt. Eng.
Superintendent of Canals.

CALCUTTA,
CANAL'S SUPT. OFFICE,
19th March, 1827.

No. 72. c.

No. 2.

Estimate of Expense in widening and laying a Pucka Road of 24 feet breadth, from the disemboguemment of the Ooltadangah Canal westward, to the Dhurrunmtulla main exit, with a 2 feet drain on the land side.*

Purchase of ground necessary to complete 27 feet in width, from Koolya Bridge westward.

	L.	B.	Sqr. feet.
Mr. Nicholson's garden and wall,	150	$\times \frac{20}{2}$	1,500
Mr. Crawley's property,	600	$\times 8$	4,800
Kimabor,	300	$\times 5$	1,500
Kino Mistree,	130	$\times 5$	650
Rajub Jammadar,	110	$\times 10$	1,100
			<hr/> 9,550 <hr/>
		Cottahs.	Chts.
		or 13	$4\frac{1}{4}$
		@ 100 per Cottah,	1,326 9 0

On the Company's property where the road is not 10 feet,
the knocking down of 19 Huts belonging to renters will } 380 0 0
be necessary, estimated remuneration @ 20.

Pucka Road.

Length from Bridge Eastward to new Canal,	1,800
Do. Do. Westward to Road,	3,350
End uniting to Mowlalleel's Durgu Road,	200
Road through the wood bazar to Circular Road,	800
	<hr/>
Total length,	6,150
6,150 Running feet \times 27 feet breadth,	16,650
24 feet road 3 feet for drain, @ 7 $\frac{1}{2}$ 0/0 feet	11,623 8 0
	<hr/>
	13,330 1 0
Adjusting slope, contingencies, &c. @ 5 $\frac{1}{2}$ feet	666 8 0
	<hr/>
	13,976 9 0

(Signed) T. PRINSEP, Lt. Engr.
Superintendent of Canals.

CALCUTTA,
CANAL'S SUPERINTENDENT OFFICE,
19th March, 1827.

* Nothing appears to have been done with reference to the purchase of the ground referred to in this Estimate.—J. M.

No. 72 $\frac{1}{4}$.

To LIEUT. T. PRINSEP,
Superintendent of Canals.

SIR,

Dated 27th March, 1827.

I am directed by the Canal Committee to acknowledge the receipt of your Letter No. 33, of date the 19th March instant, with its enclosures.

Before submitting to Government the proposition contained in the 9th paragraph of it, the Committee would wish to be informed whether the same want of tenacity in the soil of the Banks of the Canal exists the whole way from the Cooleah Bridge east to Baleah Ghaut, for should such prove to be the case, it will be perfectly useless constructing the Puckah Road, Drains and Tunnels of Exit for the distance proposed by you, because the Canal below the Bridge must, as a consequence, gradually fill up, rendering it impassable for boats to reach that part of it where the depth would be preserved by the adoption of the plans proposed by you.

I am therefore directed to request you will favour the Committee with the information required, as relates to both the North and South Banks of the Canal generally.

CANAL COMMITTEE'S OFFICE,

I have, &c.

CALCUTTA :

(Signed) J. N. JACKSON,

27th March, 1827.

*Secretary Canal Committee.*No. 72 $\frac{1}{2}$.

No. 94.

To H. T. PRINSEP, ESQ.
Acting Secretary to Government.

SIR,

With reference to the annexed extract of a Letter from Lieutenant T. Prinsep, Superintendent of Canals, dated the 19th March, and to the statement which accompanies it, showing the encroachments that have been made upon Land, the property of Government, situated along the bank of the Entally and Balliaghat Canal: I am directed by the Canal Committee to request, that they may be informed in what way they should proceed to effect the recovery of the Land described by Lieutenant Prinsep, which amounts, as per his statement, to 18 Cottahs, 12 $\frac{2}{3}$ Chittacks.

CANAL COMMITTEE'S OFFICE,

I have, &c.

CALCUTTA :

(Signed) J. N. JACKSON,

11th May, 1827.

Secretary Canal Committee.

NOTE.—There is no trace of any reply having been made by the Government to the above Letter, or what was done to recover possession of the 18 Cottahs, 12 $\frac{2}{3}$ Chittacks of Land.—J. M.

No. 73.

No. 41.

To MAJOR J. N. JACKSON, A. Q. M. G.,
Secretary to the Canal Committee.

SIR,

4th April, 1827.

In reply to your Letter No. 60, of 27th ultimo, I have the honour to state upon the several points therein alluded to—

That in the first place, the Ooltahdanga Canal, agreeable to Major Schalch's Scheme, will furnish a current of water during the nine dry months of the year, which will be sufficient to keep its own bed, and that of the part of the old Canal eastward from its junction, clean from any sediment that would be created by the defects which I have proposed to remedy in the part westward of the junction, in which the water will still remain stagnant,—and that in the second place, as the length of Road from the junction eastward is $1\frac{1}{2}$ mile, with a Road on each bank, I have considered the expense of laying the whole with bricks too great to propose to the Committee, merely on the score of improving the thoroughfare.

The badness of the soil is general; but much the worst along the North bank, from the lime and rubbish which is left on its surface in the constant landing of the trade of the Nullah—along the South bank, there is already some vegetation upon the slope, which may be increased when its steepness is reduced, and the surface of the road properly drained, to prevent the washings from it falling over [the] slope into the Canal. This vegetation is the consequence of there being little or no landing of goods on the South bank.

The Carting of goods along the roads eastward of the disembogement of the Ooltahdanga Canal, must, as I have stated in the Report, considerably decrease on the opening of that Canal, and I am inclined to the opinion that, notwithstanding the badness of the soil, the Kutcha Roads, with proper care in Draining them, will be found sufficient for the diminished thoroughfare which may be anticipated.

The Committee will understand by a reference to my first Report* upon the subject of this Canal, that while the water westward of the Koolya Bridge is stagnant, there will still remain two causes of constant deposit, namely, the constant washings and filth brought by the Town-drains through the Durrumtollah Main Exit, and the occasional flow of turbid water from Tolley's Nullah during the rainy season. The last of these may be rendered by a draw-hatch to the principal Drain in the neighbourhood of the Bhowanipoor Road. The first however does not admit of so easy and immediate a remedy. A periodical expense in clearing out this part of the Canal is therefore unavoidable, although by the means proposed, it will be considerably lessened.

I have, &c.

CALCUTTA,
 CANAL SUPERINTENDENT'S OFFICE:
 4th April, 1827.

(Signed) THOS. PRINSEP, Lt. Engrs.,
Superintendent of Canals.

* Dated 20th
 November, 1826.

No. 74.

No. 91.

To LIEUT. THOS. PRINSEP,

Superintendent of Canals.

SIR,

In reply to your explanatory Letter, of date the 4th ultimo, on the subject of the measures proposed by you in a Letter dated the 19th March last, for improving the Entally Canal, I am desired by the Canal Committee to inform you, that previously to their sanctioning the commencement of the Puckah Road, Drain, and Tunnels of Exit on its Northern Bank, and the Excavation connected therewith, between the disembogueement of the Ooltahdanga Canal and the Durrumtollah Main Exit, they are desirous of witnessing the completion of that part of the Ooltahdanga Canal situated between Chitpore and the existing Canal, through which you anticipate that a sufficient current of water will flow during the nine dry months of the year to keep its own bed clear from sediment, as well as that part of the Entally Canal eastward from the junction towards the Salt Water Lake.

The statement of encroachments made by individuals upon the Company's ground on the bank of the Canal, which accompanied your Letter of the 19th March, falls very far short of what has been anticipated. Measures will, however, be immediately adopted for obtaining re-possession of the 18 Cottahs, $12\frac{2}{3}$ Chittacks of Land described in the statement above alluded to.

With regard to the additional ground that is required on the South bank of the Canal to the eastward of the Cooleah Bridge, between the Points A B and C D, (Vide survey), amounting to 9 Cottahs, $13\frac{1}{2}$ Chittacks, I am directed by the Committee to state, that provided possession of the above ground could be obtained on reasonable terms, they would propose to Government the expediency of its being purchased and thrown into the General line of Roadway, averaging 24 feet in breadth; you will therefore be pleased to ascertain* the rate at which the ground could be obtained, and communicate the same to the Committee at your earliest convenience.

I have &c.

(Signed) J. N. JACKSON,
Secretary Canal Committee.

CANAL COMMITTEE'S OFFICE,

CALCUTTA:

7th May, 1827.

* NOTE.—There is no trace that Lieutenant Prinsep ascertained the rate at which the ground could be obtained, or that the Committee addressed the Government upon the subject.—J. M.

No. 81.

No. 66.

To MAJOR J. N. JACKSON,

*Assistant Quarter-Master General,
Secretary to the Canal Committee.*

SIR,

I have now the honour to forward the Accounts and Papers for June, which, with a few trifling exceptions as per margin,* to form additional Bills during the month of July, will close the expenses of the season, as sanctioned on my Estimates of 16th October 1826, amounting to Rs. 42,707:8: 0.

2. As the several works may be considered perfectly distinct, after a few general remarks I will proceed to detail the result of my operations upon each consecutively. I forward accompanying, a General Abstract of the Expenditure of the season, and four different Plates as per margin, for reference, to illustrate the observations that I may have occasion to offer.

3. The operations of the year will, I trust, be deemed on the whole satisfactory, in as far as they extend. They have necessarily been limited, and comprise many points, the ultimate success of which, remains still to be developed, as depending upon future circumstances.

4. The new navigable communication, between the Lake and the Eshamuttee at Hosynabad, is not completed by the present year's proceedings, and may perhaps require even beyond another season to perfect. This portion of the undertaking, to which I have considered it advisable at first to confine my operations, is that upon which the chief expense was anticipated in the original scheme: it comprises the most difficult part, indeed the only part of which the feasibility was at all doubtful; and when finished, will replace that portion of the old route towards Calcutta always, and hitherto considered, the most replete with danger and inconvenience.

Old Scheme.

* Hosynabad to Choumooha.	11 Miles.
Chultabarya.	3½
Ditto, to Bhaminghatta.	7
	<hr/> 14½ Miles.

Present Scheme.

* Hosynabad and Baley-	
gunge.	3 Miles.
Bhowanipore.	2
Hinchee Khal to Bairemoree.	1½
Chultabarya.	2½
Bhaminghatta.	5
	<hr/> 14¼ Miles.

5. The estimated length required for actual excavation in this part was $21\frac{1}{2}$ miles: The surveyed line adopted, reduces it to little more than 14*—which, with the various subsidiary expenses of Tracking-paths, deepening old Nullahs, and damming up others, will reduce the expense to little upwards of 1,50,000 in place of 2,10,000, as originally sanctioned; a saving which will allow funds to do much more for the perfection of the part of the navigation, than could have been originally expected.

6. The scheme, which I have proposed for the operations of the approaching season, has for [its] object, to open the communication along this line, and render it fit for a part of the Craft, if it is not possible to render it adequate during the season, to all the purposes of the eastern trade.

7. The operations in Dredging the Channel through the Lake, and deepening the Canal in immediate connection with Calcutta, have been attended with a success that promises every probability, with the aid of another Dredging Boat, as recommended in the following remarks, of placing that Channel on a most respectable footing in the course of twelve months, and considerably improving the facilities of navigable approach to Calcutta. I cannot refrain here from calling the attention of the Committee to the increased difficulties that

* A Bill for Balya-
ghat 248:11:3
" Chultabarya
401:6:10.

Plates No. 1, A.
Dredging machine.
" 2. B. Chulta-
barya.
" 3. C. Bhowani-
poor.
" 4. D. Bhamin-
ghatta.

seem yearly, to press more injuriously upon the trade that is brought to Calcutta by the Soondurbun route. Although piracy is now no longer dreaded, the frequency of wrecks appears rather to increase than diminish. The passage through Tolley's Nullah appears also yearly to increase in difficulty. It is now impracticable for laden Craft of any size, except during the spring tides ; and as, when the removal of all the old confined bridges has had full effect, the rise and fall of tide in that Nullah will probably increase, (the passage becoming necessarily more effected by the variations of the tides in the Hooghly River), it may be expected to become even more limited in its facilities of navigation.

8. The necessity of providing a Canal of Communication between the River and Soondurbun Navigation, upon different principles from the present one, appears therefore to be daily more urgent ; and I trust the Committee will not consider me importunate, when I express my earnest hope, that the purchases of ground which are conducting under their immediate superintendence, may be brought to a conclusion at an early period ; to allow of my commencing the execution of this part of the undertaking, from which so much immediate advantage is likely to result. The present state of these purchases not allowing me to anticipate the possibility of commencing next year upon the Circular Canal of Communication. I have hitherto withheld the plans and estimates for its detail, which I had been preparing to submit—I shall however, be ready to forward them for the inspection of the Committee, whenever any prospect is offered of bringing the purchases to a close.

9. The Committee will observe, that the different works have generally fallen within the rates of their Estimates. The average inclusive rate per Chowka of the Chaltabarya excavation falls considerably below that of the Hoseinabad and Bayley Gunj excavation of 1823, and although it is beyond Major Schalch's original Estimate, which was assumed upon the old rate of Tank-Dredging [? Digging] in Calcutta of 1800 to 1810 ; Major Schalch's general rate of 10,000 Rupees per mile, will still be found correct as an average.

10. I have found myself necessitated to entertain an establishment for the conduct of the Chaltabarya and Mufussil operations of the season, beyond that authorized as the permanent establishment of the office ; the expense of which I have hitherto charged to the work. As however, this cannot be done during the rainy months, when no works of this kind are proceeding, and it is highly inadvisable to discharge the head and responsible sirkar, to whom I necessarily look for the recovery of all outstanding balances that have occurred under his management, I have to request the sanction of the Committee to the continuance of his salary of 50 Rupees per mensem, and that of his under-sirkar of 16 Rupees ; till it can again be charged to the works.

11. The Committee must be aware, that I have hitherto conducted the business without any European assistance except that of Overseer West, for three months, whom I was obliged to discharge on account of ill health ; and Private Turner, whose services have only been useful as a Surveyor and Draughtsman.

12. As the work proceeds, and objects that require supervision multiply, the Committee can scarcely expect that I should be able to proceed in the same manner. I have therefore to hope, that I may be allowed to select some intelligent European to be permanently attached to the Department, who may be continually useful as a practical Mechanic and general Overseer. In case the Committee deem it advisable to construct more Dredging machinery, or allow me as suggested to construct any economical machinery for draining off the water that always interrupts the excavation of the Muffussil Canals, the services of such an Overseer will be immediately required, and I shall not fail diligently to search for some person of the description best qualified to answer the purpose. In the meantime I have to hope, that I may be allowed to bring on the strength of my Establishment, an Apprentice (F. Mullins), whom I have entertained since January at my own

expense, at 30 Rupees per month, to be charged to the Dredging operations, to which he has been attached from the first ; his salary to commence from the 1st July.

13. Any further European Assistants, covenanted or uncovenanted Officers, as it must depend upon the extent of operations, which it may be thought advisable for me to undertake at the same time—it will be quite unnecessary for me to consider in this place, and I rest confident in the judgment of the Committee, to suggest to Government, any thing upon this subject that they may hereafter see occasion for. I have only to remark, that while the operations are limited to the Scheme in the accompanying proposition, I feel myself perfectly capable, while enjoying health, to carry them on without any Covenanted Assistant. If however, circumstances put it in the power of the Committee to order a commencement of operations upon the Circular Canal in the present year, I fear my own unassisted exertions will scarce suffice to superintend the whole operations in that satisfactory manner, which could be wished for [in] such an extensive undertaking.

The following pages contain my observations upon the works of the season.

CALCUTTA :
CANAL SUPERINTENDENT'S OFFICE,
28th August, 1827.

I have, &c.
(Signed) THOS. PRINSEP, *Lt. Engrs.*
Supt. of Canals.

(A true Copy.)
J. N. JACKSON,
Secretary Canal Committee.

No. 81. a.

Balliaghat or Eastern Canal.

1. The total expenses on this head, have exceeded the estimate of Rs. 4,903 : 8 by the trifling sum of Rs. 78 : 14 : 3 as per abstract, chiefly on account of great excess of work executed in the principal item of excavation.

2. I have been unable to execute the whole estimated work upon the slope of the banks on account of the narrowness of the Road, as stated in my Report,* and to the West of the Koolya Bridge I have thought it advisable not to do any thing immediately to the slope, until the Committee are enabled to authorize something more effectual for the improvement of the Road along its bank ; meantime, I have incurred an expense of Rs. 385 : 2 in sloping and draining the Road East of the bridge, to prevent dilapidation and improve the thoroughfare.

3. The nature of the season has occasioned this latter work to proceed but slowly, and I have lately stopped it altogether, until the rain should cease.

4. If the Committee approve of the measure, I will expend whatever further sum may be authorized, for placing these two Cutcha Roads in a proper state of repair. The thoroughfare is very great along them, and their present state far from efficient.

* No. 36, of 19th March, 1827.

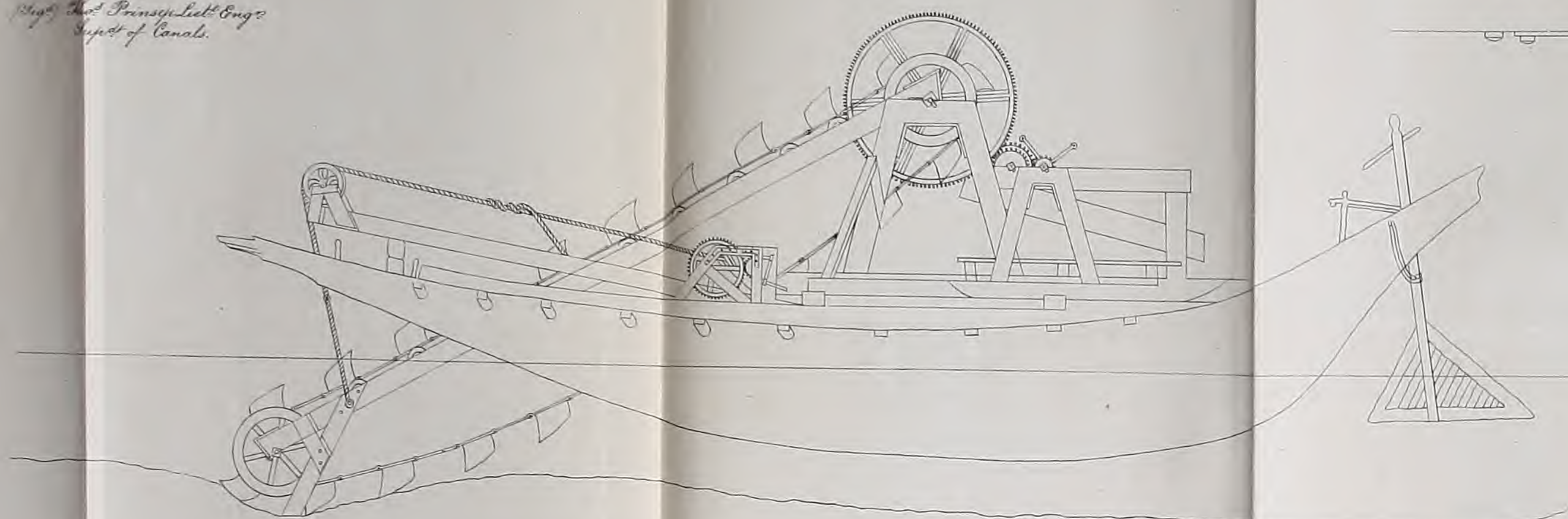
DREDGING FRAME

constructed upon
Two native Boats of 600 maunds each
for excavating in the
Salt water Lake

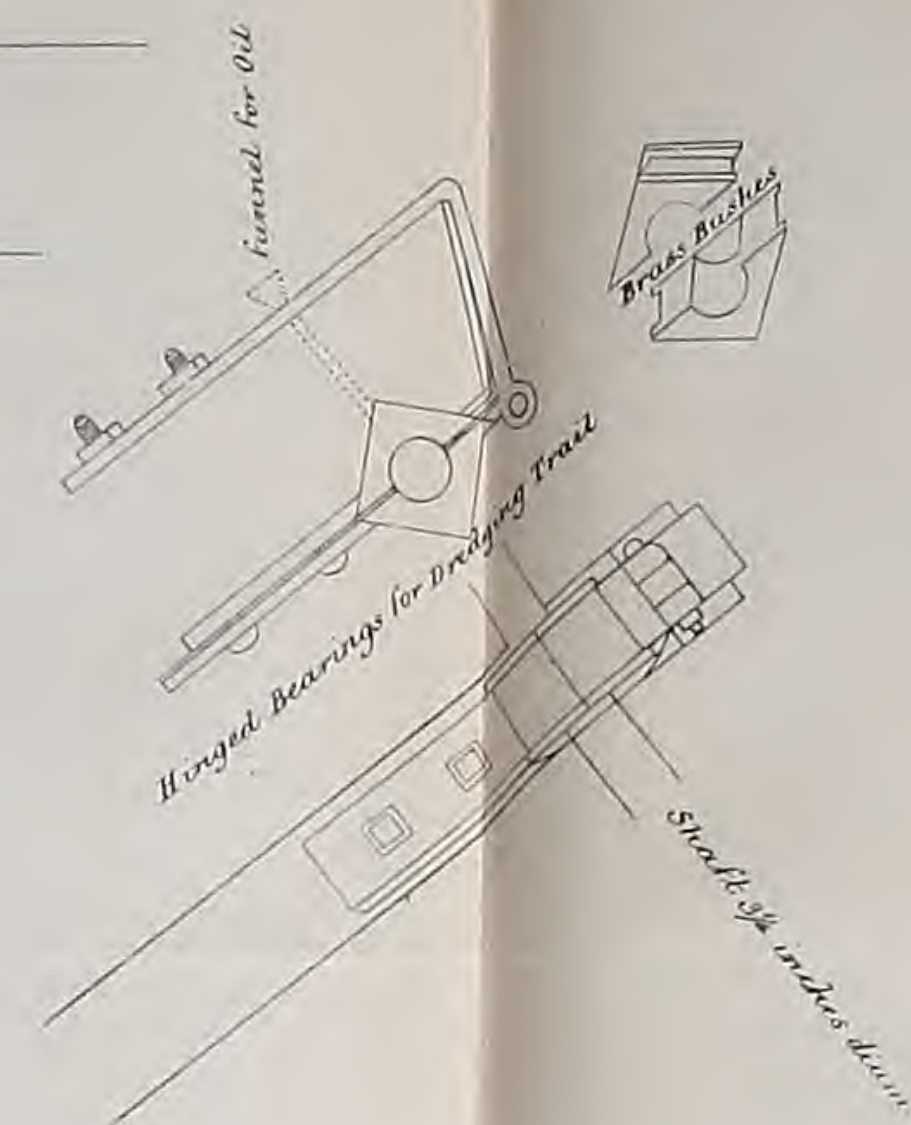
Calcutta July 1837

By J. H. Prinschall Esq.
Super of Canals.

Side Elevation



Smaller bearing



Fixed for oil

Hinged bearing for dredging frame

Brushes

Shaft 4 inches diam.

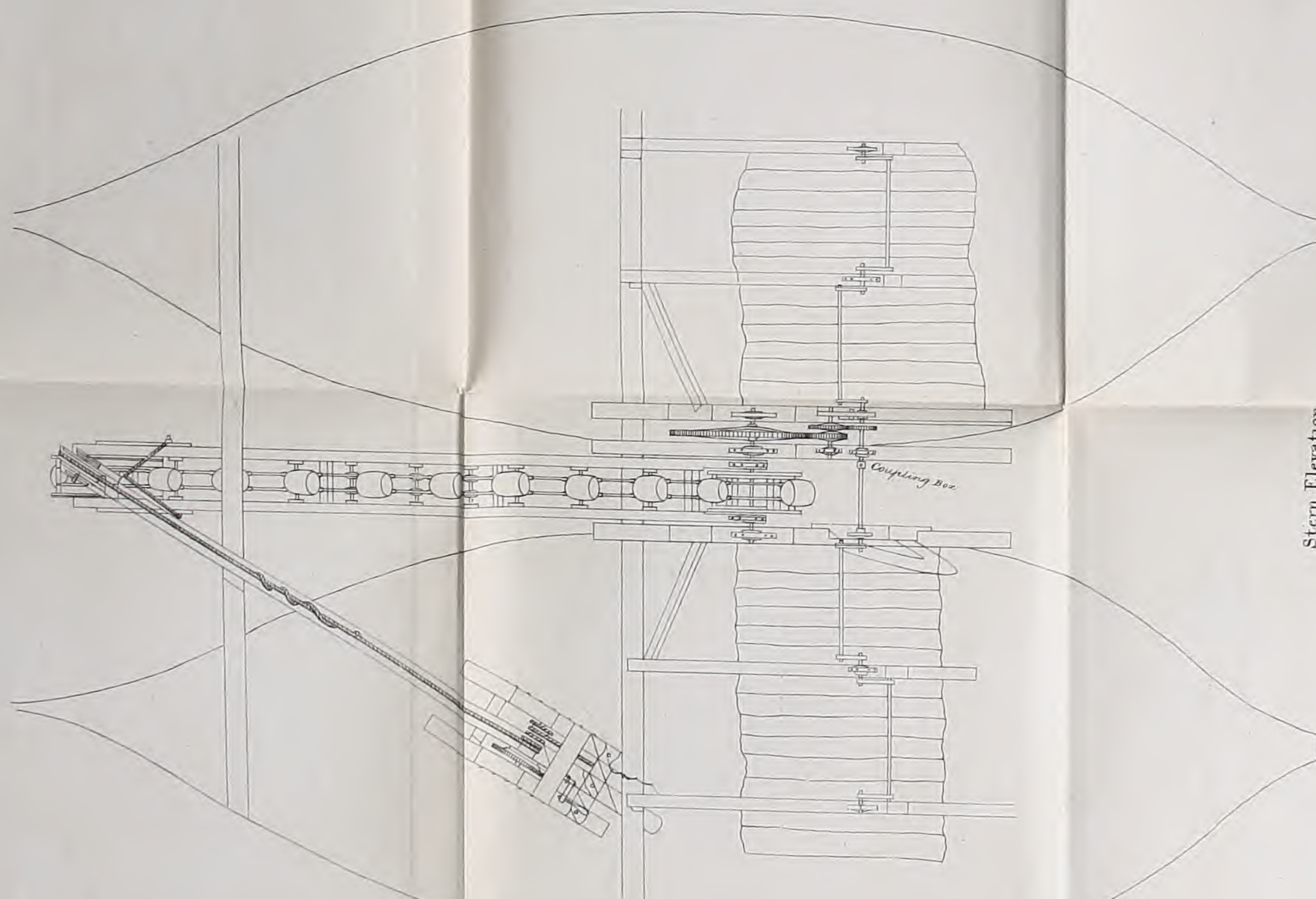


Groove plate

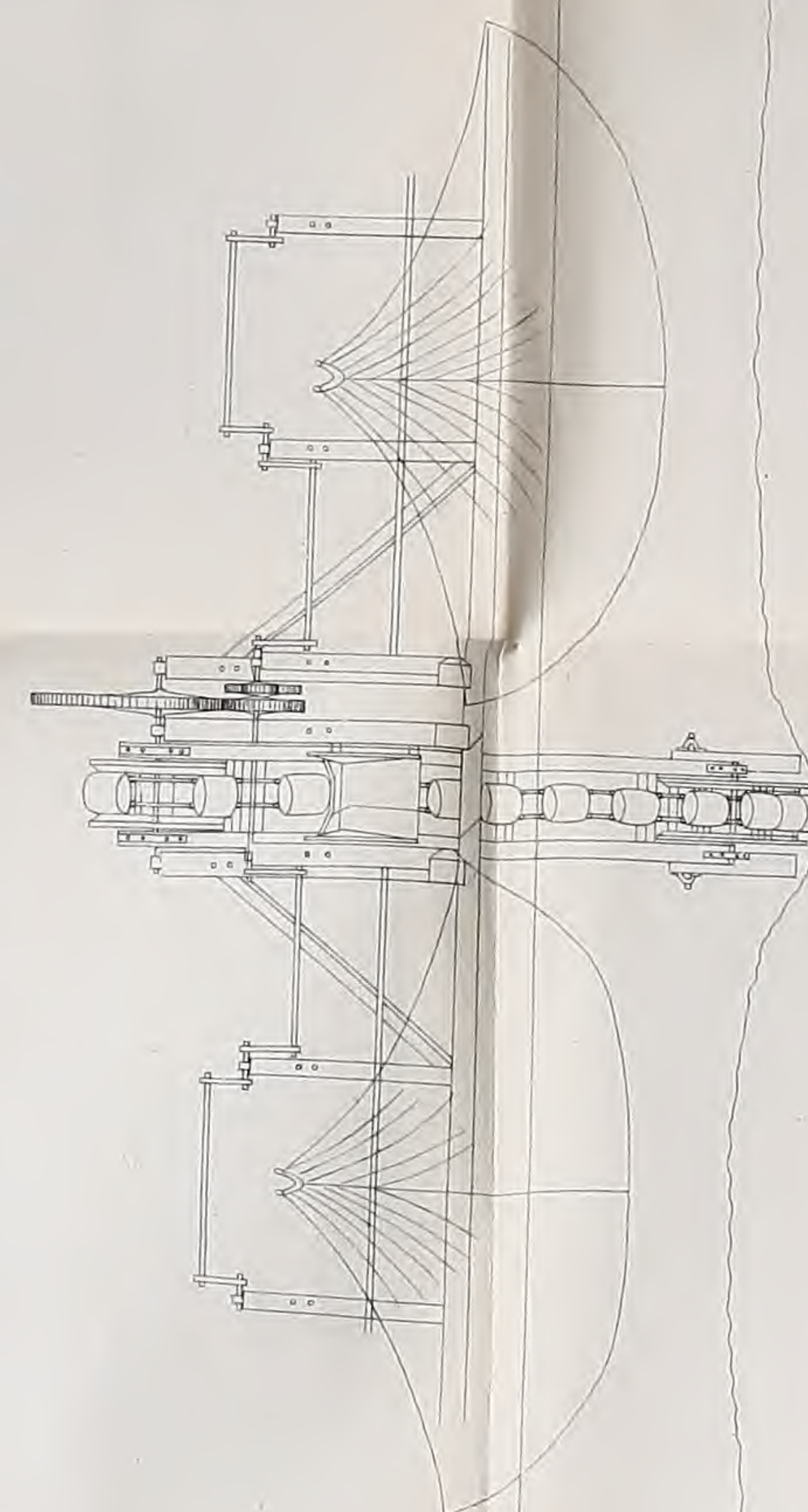
Tankler
Showing Groove Plate



Branch of chain



Stern Elevation



Scale for elevations

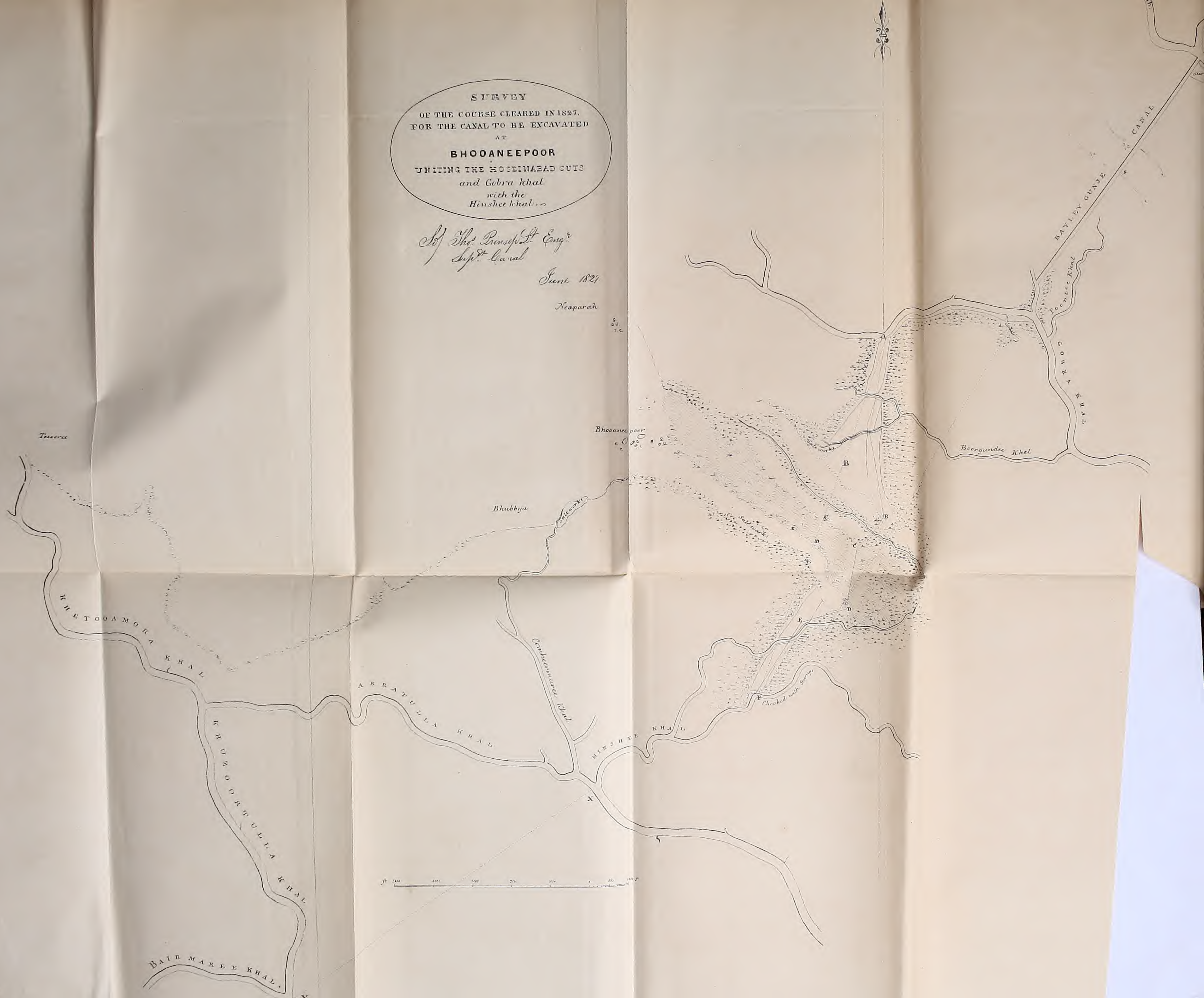


SURVEY
 OF THE COURSE CLEARED IN 1827.
 FOR THE CANAL TO BE EXCAVATED
 AT
BHOOANEEPOOR
 UNITING THE HOSEINABAD CUTS
 and Gobra khal
 with the
 Hinghee khal.

*Sd/ Tho. Prinsep Lt. Eng^r
 Supt. Canal*

June 1827

Naparah



No. 81. b.

Dredging Machinery and Operations in the Salt Lake.

1. The Dredging Machine constructed upon Native Boats, by order of the Committee, from the materials found in store, of which I have the honour to forward a drawing, was completed and commenced excavating in the mouth of the Eastern Canal on the 15th July. Its expense has scarce exceeded the Estimate, although many circumstances have contributed to swell that amount.

2. The Machine most perfectly answers my expectations, and is capable of excavating upwards of 2,000 Mds. of soil during the day with perfect ease [to] itself, and with 18 men working at the handles. At present, while I have only two Receiving Boats, of 300 to 400 Mds. burthen each, its daily work amounts to four Boat-loads, or upwards of 1,200 Mds., to accomplish which, the machinery is in actual motion very little more than four hours.

3. The two Nuddya Dredging Boats were likewise repaired, caulked, and tinned early in July, and they first commenced excavating in the Lake Canal a few days after the 11th July.

4. The passage of the second from Kidderpore was somewhat delayed, and as some time was spent in caulking and repairing the five Receiving Boats, which arrived from Mr. May on the 13th July, and were found on their arrival to be leaky, and in other respects very defective, the second Nuddya Boat was enabled to work very few days in July; during the month of July the number of Boat-loads excavated and carried away amounted to fifty-six, or equivalent to 16,800 Mds. of soil.

5. The three Boats are now in full work, excavating at the rate of 3,800 to 4,000 Mds. per diem, viz.

	Crew.	Coolies.	Boat Loaders.	Mds.	Hours of work.
Canal Committee's Boat,	18	30	4	1,400	5
No. 1, Nuddya, Messrs. Jessop, ..	18	36	4	1,200	5
No. 2, J. Kyd, Esqr.,	18	50	4	1,200	7

6. The flat European Receiving Boats, attached to the Nuddya Dredging Boat, are capable of holding more than the quantity now filled upon them, but their shape, and the shallowness of the place in which they work, will not allow it. By adding to the number of Mud Boats, the quantity excavated by all three Dredgers, might be increased nearly two-fold; and I am now preparing two additional Native Boats, purchased under the order of the Committee, which will raise the quantity of the Canal Committee's Boat to upwards of 2,000 Mds. per day, without requiring any addition to the number of Coolies employed: whereas, to allow the Nuddya Boats to do any quantity beyond what they do at present, it would be necessary to increase the number of Coolies to 50 or 60 from the present number 40, to allow of a relief. It is now quite evident, that the method of working the machinery by winches adopted in the Committee's Boat, is by far the most economical in its effect, and with very few additions, which will be furnished gradually during the progress of the work. The Canal Committee's machinery, but for the disadvantage of resting upon Native Craft, is capable of being rendered far superior to either of the other two Boats, as they are constituted at present both in its effect and economy.

7. The machinery at present resting upon Native Craft as in the drawing, is so managed, that in case of any injury to either of the Boats, the weight may be taken off from the injured one and another Boat substituted without dismantling the machinery. I have with this intent attached a spare Boat to remain ready, as all such Craft are subject to accident in shallow water.

8. It will, I expect, be found necessary to shift the machinery at least twice during the year, as Native Boats cannot be expected to remain longer in salt water without caulking.

9. If however, the Committee, now that the perfect success of the apparatus is established, are desirous of giving it the superior advantage of resting upon substantial European Boats, I will make search for some Craft that may be fit for the purpose, or estimate the cost of building such in the most economical manner.

10. Judging from the work executed by the present Dredging Machines, I can scarce expect to complete the entire excavation of the Canal through the Lake in two seasons with the present means; even although I should have the assistance of Mr. May's machinery for four months every year. I am therefore induced to suggest the propriety of constructing a second Dredging Boat, upon nearly the same construction as the Committee's Dredging Boat, the expense of which, judging from the price of articles found in store,

* Expended on this Estimate of Rs. 40,000,

By Major Schalch in 1823-24.

Deepening East Canal, ..	4,436	12	0
Embankment in Lake, ..	1,451	7	6

By Lieutenant Prinsep in 1827.

Deepening East Canal, ..	5,082	6	3
Dredging apparatus, ..	4,494	1	3
Cost of stores for above, as per Jessop's bill, ..	3,307	3	7
Mr. May's bill for dispatch, ..	302	8	3

Total, 19,074 6 10

Add expenses attending Mr. May's Boat till November next, .. 2,000 | 0 | 0 |

Working Committee's Boat for 12 months, .. 4,000 | 0 | 0 |

Total, 25,074 6 10

Remains of Estimate, .. 14,925 9 2

as per Messrs. Jessop's bill, and the expense incurred by myself, would not exceed Rs. 8,000, and the machinery would prove most essentially useful, if not absolutely necessary in other parts of the undertaking; even when the Channel through the Lake is completed.

11. There will still remain, as per marginal account, in January next, a sum of 15,000 Rs. of Major Schalch's original Estimate* of Rs. 40,000, for Lake and Eastern Canal, besides the value of the machinery—it would therefore appear highly advisable to expedite the completion of this part of the undertaking by an outlay in constructing more machinery of this kind, which will, in all likelihood, prove so useful afterwards to other parts of this extensive undertaking.

No. 81. c.

Chaltabarya Canal.

1. The operations under this head have not been attended with such perfect success as could have been wished. The Canal however, I trust, with very little more expense and in no very long time, will become perfectly fit for all the purposes of Navigation.

2. A strata of oozing sand, of the nature of which I have no doubt the Committee are perfectly well informed, has baffled all my endeavours to excavate beyond the depths stated in the longitudinal section inserted in the Sketch No. 2 or B.

3. The expenses incurred on this Canal have amounted to Rs. 17,564 : 8 : 4½, as per general abstract, for excavating 10,045¹²/₁₆ Chowkas, of 729 cubic feet each, in 12,930 running feet; or upwards of 2 miles, and Rs. 1,665 : 4 : 6½ for deepening, widening, and clearing 3,500 running feet of the bed of the old Nullah, which has been converted into part of the Canal. The inclusive rate† of excavation per Chowka is thus reduced to

† Average rate of excavation, ..	Rs.	As.	Ps.
Average rate, including Contingencies. ..	1	8	5
	1	12	0

much less than that incurred upon the Hoseinabad Canal in 1823, and if the Canal could have been excavated to the full depth, this rate would have

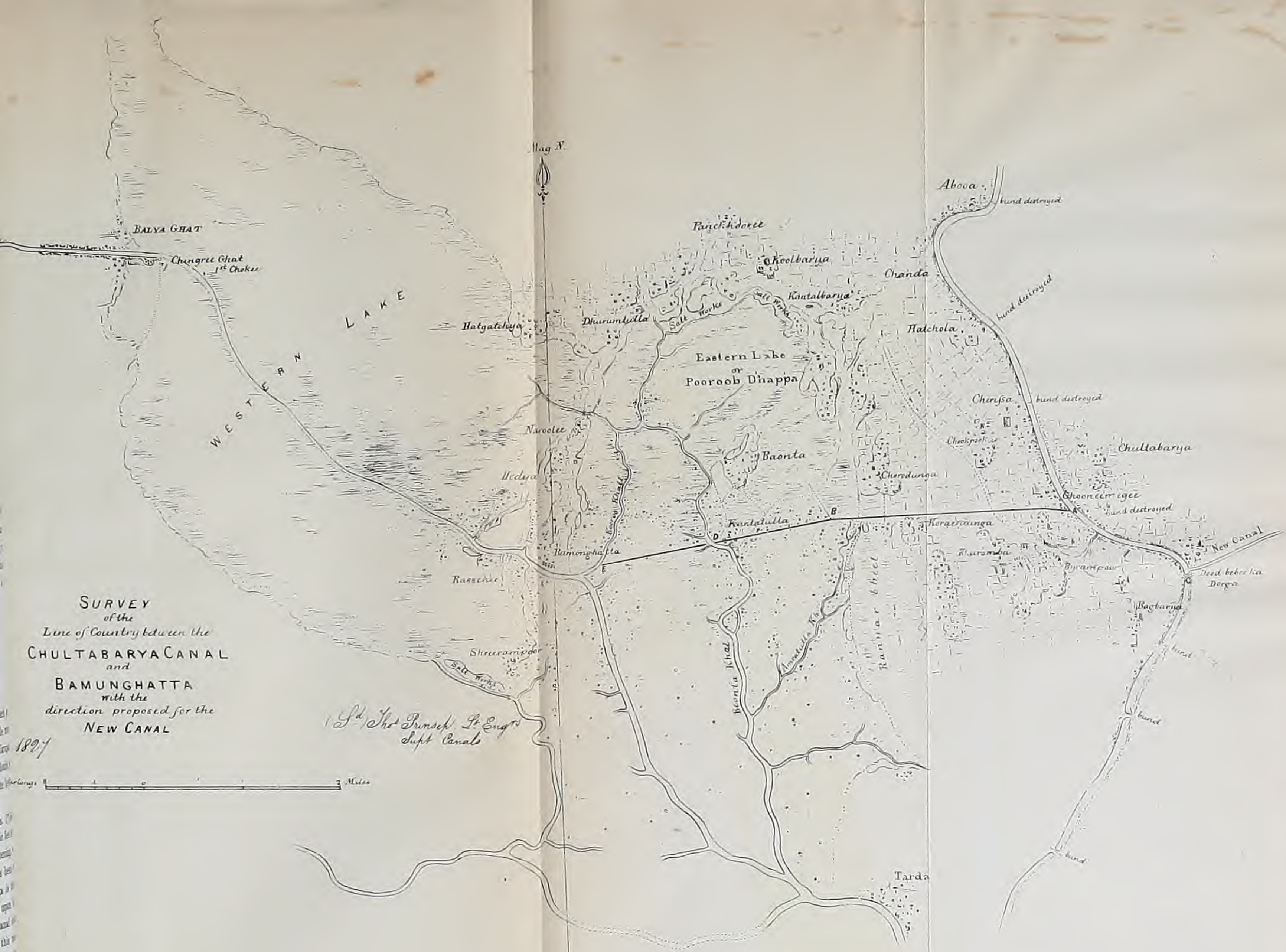
been reduced still lower, and I can now confidently assure the Committee, that the average rate of 10,000 Rs. per mile assumed by Major Schalch for excavation out of the precincts of Calcutta, will not be exceeded.

SURVEY
of the
Line of Country between the
CHULTABARYA CANAL
and
BAMUNGHATTA
with the
direction proposed for the
NEW CANAL

1897

*(Sd) Tho Punsap Lt Eng^r
Supt Canals*

Scale 0 1 2 Miles

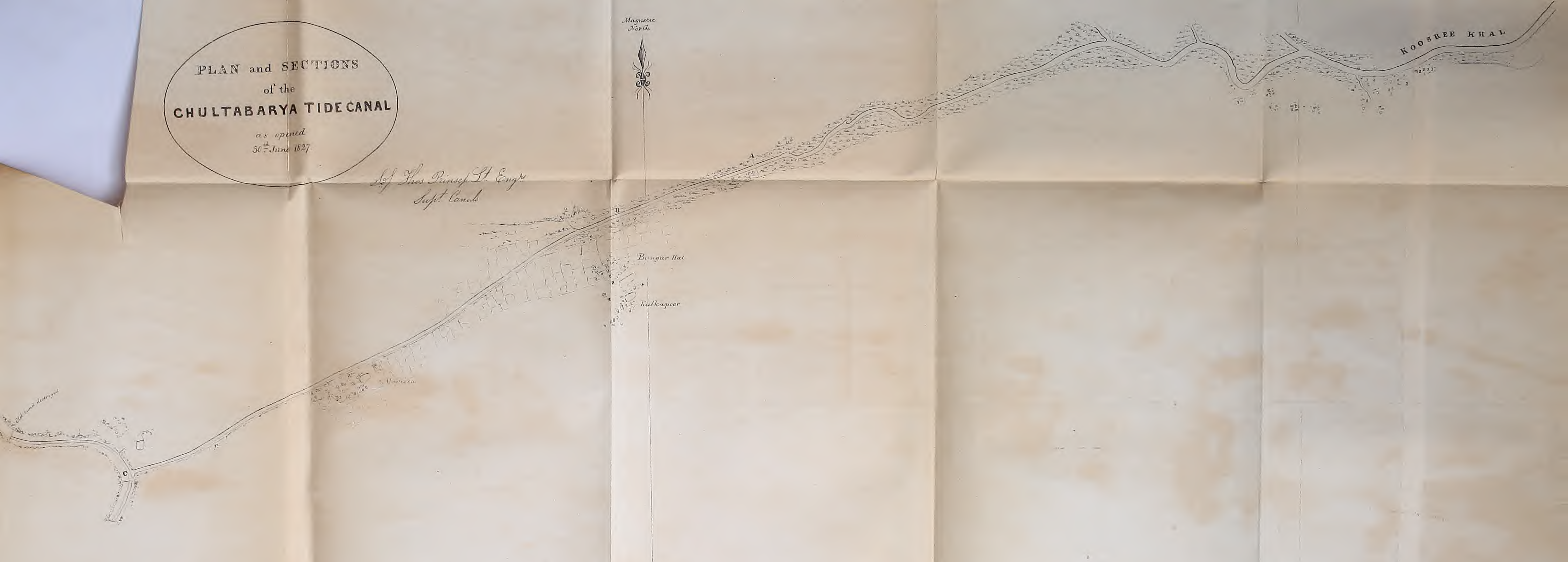




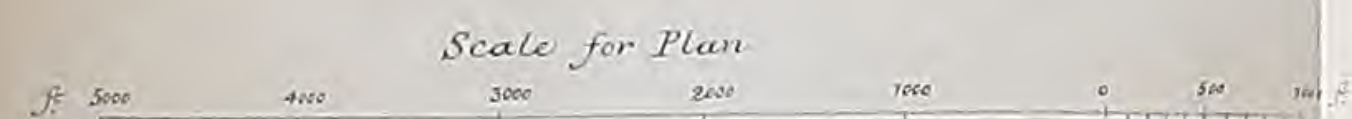
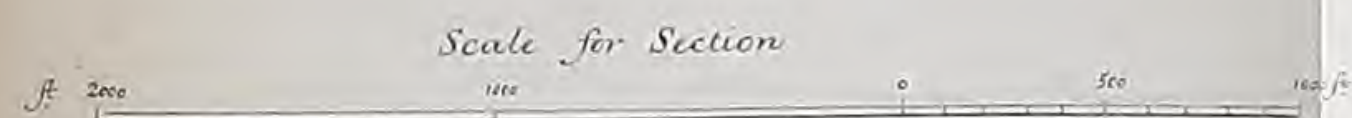
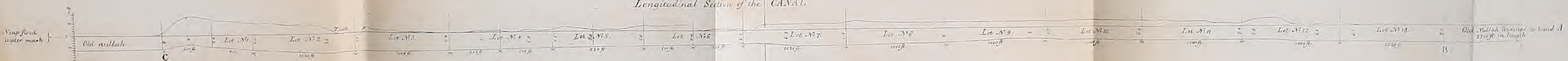
PLAN and SECTIONS
of the
CHULTABARYA TIDE CANAL

as opened
30th June 1827.

Lt J. P. Pinsep Lt. Engrs
Supt. Canals



Longitudinal Section of the CANAL.





4. The balances* left outstanding, (chiefly the consequence of the difficulty created by the occurrence of this stratum of oozing sand) amount as per list accompanying, to what the Committee will acknowledge to bear a very trifling proportion to the outlay for a work of this nature executed on contract.

* Outstanding balances as per Statement No. 7, amount to .. Rs. 1,992 : 4 : 6 $\frac{3}{4}$

5. The present section of the Canal will afford at high water during the neap tides, a depth of no where less than five feet, in general from 7 to 8—with the exception of one spot near its western mouth, where the sand rose higher than elsewhere, and as the current which I have introduced into the Canal is likely quickly to excavate the bed still deeper, it may confidently be expected, that there will be upwards of 7 feet of water every flood-tide in the Canal after the present rains.

6. The oozing sand in question is in nature a perfect fluid, and therefore easily moved—its thickness I ascertained, by boring, to be from 5 to 9 feet in different places. It is evidently a tide deposit, and I should think of a very slack tide. I am therefore induced to place great confidence in the method I have adopted for clearing out this sand to a greater depth, and as the same principle if successful, may be applied in other cases, I will here explain its chief outlines for the information of the Committee. Its action will be gradual but economical, and I trust tolerably certain, if carefully watched, and every requisite attention is paid to clear away the banks and bed of the two ends, that no obstacle may occur to the free passage of the tide.

7. The principle in question consists in providing to the Canal which it is required to scour or deepen, a reservoir or basin, in which the flowing tide may spread; the discharge in quantity, from which, through the Canal, (on account of the great body of water having comparatively little effect in lowering the surface of such reservoir,) will create a slope in the Canal tide during the ebb; productive of a much greater velocity of current than could be occasioned by an ordinary tide in such a section.

8. The velocity of current required to move sand, according to the Chevalier DuBuat's experiments, was† 8 to 10 inches per second at the bottom, which reduced to the surface, would require a correspondent velocity of 14 to 16 inches per second, or about three-quarters of a mile per hour.

† Vide DeHaviland's translation of DuBuat, page 115.

9. In the case of the Chaltabarya Canal, I have applied as a receptacle for the tide, the old bed of the Nullah that formerly connected Ooryaparah with Tarda, which has nearly choked from having been bunded across for perhaps the last 40 years.

10. It appears to have been once a Nullah of considerable dimensions and importance, its present width at high-water, neap tides, averages upwards of 300 feet, and depth about 7. To allow a greater effect, and secure a greater body of water, I have cleared away the several mud bunds that crossed its bed in several places, between the west mouth of the Canal and Ooryaparah, and have constructed a solid bund‡ below the junction of the new Canal, to prevent any possible access of tide from Tarda.

‡ At C. in Plate B.

11. It is not difficult to demonstrate, that the fall of water through the Canal of 3 miles in length, would for 4 hours of the ebb reach, if not exceed, 3 feet in all, or 1 foot per mile. Now, in this case, if the section were only 420§ square feet, the velocity agree-

§ Breadth 70 \times 6 depth.. .. = 420

|| DeHaviland, Tables A and B, pages 77 and 82.

Enter with Hyd. mean rad. or $r = 60$ in.

$$\text{Slope or } \frac{1}{2} = \frac{1}{5280}$$

able to DuBuat's Tables,|| would be 32 inches per second, or $1\frac{3}{10}$ miles per hour: which is more than that required. It cannot be said that the flood-tide would bring back as much as the ebb would carry down, inasmuch as it would require a greater force to carry the sand up an inclined plane, which must take place in its return to the Canal.

12. There is therefore every reason to suppose, that the Chaltabarya Canal may be thus rendered in every way sufficient without much further expense, and in no very long time.

No. 81. d.

Bayleygunge Canal and Dam across the Kullooar Khal.

1. Of the 10,000 Rupees inserted in my Estimate for these two works in connection, I have thought it advisable to incur an expense of only Rs. 2,792 : 6 : 4½.

2. I have perfectly cleared the unfinished bed of the Baley Gunj Canal,* of which

* At an Expense of Rs. .. 2,052 14 9 I found many parts obstructed by roots and stumps of trees, and many places not excavated at all in 1823, which served as divisions between the different lots given to the contractors. I have also excavated the shallow parts of the bed, so as to complete the depth of water where shallowest, to 5 feet at high-water, neap tide. Before quitting the spot, I took the precaution of destroying the bunds at both ends, and the Channel is now perfectly clear for the introduction of any current.

3. Upon the second work I have expended only Rs. 739 : 7 : 7, in preparing ground for excavating sufficient earth to form the dam. I have also renewed a former contract for Soondree spars with Luckun Suttra, against whose name there is a debit of 600 Rs. in the former list of outstanding balances. This individual had already collected a quantity to the value of two-thirds of his advance, when the operations of 1823 were closed; and is now willing to make good the debt, by collecting the whole before October next, when the work must begin.

4. In my former Report, I alluded to several points which required investigation, before the execution of this work. I beg leave now to offer the result of many observations made during the season.

5. It appears, that from January to June, the arrival of the flood tide at the East end of the Hoseinabad Canal, takes place at the least one hour before the arrival of the tide in the Eeshamuttee, within 250 feet of the same spot, and that, while rising, it preserves a command in actual level of generally more than one foot, which superiority it maintains at extreme flood.

6. The commencement of the ebb is simultaneous. I frequently found, however, that while the fresh water tide had fallen only 3 feet, the Salt water tide had fallen 7½ inches, and that the extreme low water of the Salt tide was one foot lower than the fresh, or more.

7. These circumstances accord with my former anticipations, and I therefore now consider the dam necessary, both to secure the neighbourhood from the great influx of Salt water, that might otherwise put them to considerable inconvenience, and as a means to excavate the Bayleygunge Canal, and procure an uniformity of current through its bed.

8. I have therefore included this work in the Scheme and Estimates for the ensuing season, and shall proceed to make instant preparation, so as to commence in October.

Clearing and Bunding for the Bhowanypore Canal.

1. The operations under this head have created an expense of 3,231 Rs. 9 As. 7 P. in place of 7,500, as per Estimate. The distance cleared is about 2 miles, which reduces the rate to nearly 1,500 Rs. per mile, as per Estimate, after making allowance for the expense of clearing the bank of the Gobra Khal, and constructing a walking bund for the passage of the Coolies to Bayleygunge.

2. The Plate No. 3 or C. will show, that I have altered the line of 5 miles, marked out in the Plan* forwarded by Major Schaleh in 1824 for this Canal, and that I have still left untouched the remaining division† X to Y, from the mouth of the Hinshee Khal to the mouth of the Bairmaree.

3. A distance of 2,000 feet has been gained in the cut across to Hinshee Khal, by commencing the Canal higher up the Gobra Khal, which here runs East and West. The straight line A, F, was first laid out and cleared for the purpose; the nature of the ground has however, rendered a deviation from the straight course necessary, and the line I have now ascertained to be most judicious is denoted by A, B, C, D, E, F.

4. The configuration of the ground, as well as the soundings I have made into its understrata, seem to give every indication of the course of some large River, or what is equally probable, as the general bearing of this tract of sand is nearly parallel to that crossed at Bayleygunge, that the tracts in question were at some very remote period, similar to the present spits of sand which are found at the mouth of the Hooglee. The line A, F, crosses two ridges of sand, B, C, and D, E, between which runs a low marshy tract, terminating in mangrove jungle South.

5. On the two ridges in question, the sand (with ooze and water) is found at 5 to 7 feet below the surface, which is at least 3 feet above high tide—so that it would be difficult to excavate more than 3 or 4 feet below H. W. neap tide. By taking advantage of the bed of a small Creek which appears to have crossed the sand, I have traced a line, throughout which, by actual sounding, I find I shall be able to excavate to the depth of 8 to 10 feet below H. W. The length of the curvè line will add only 500 feet beyond the straight distance.

6. I have thought it advisable to await the success of the Bhowanepore Canal, before incurring any expense upon the remaining division X, Y. The communication between the Gobra and Bairmaree and Chowmooh Khals will still be open by way of the Akra-tulla Nullah, which, although a little more circuitous, is sufficient in its dimensions.

* See page 16, of this Appendix—J. M.

† Now recommended by Capt. A. H. E. Boileau, and Mr. Heatly to be executed, See Appendix (J) page 5, and page 140, to Municipal Committee's 2nd Report.—J. M.

No. 81. f.

*Proposed scheme for the operations of the approaching year 1827-28.
Estimate and Plates No. 3 and 4, or C. and D.*

1. The several objects which I propose to pursue during the approaching season, are as follows:—

2. *First*, the construction of the *Dam across the Kullooar Nullah*, and *opening of Hoseinabad Canal* towards the Eshamuttee River: every preparation has been made to commence this work in October if it is approved by the Committee. The method of constructing a Dam of such large dimensions, is well known to the Natives of the district. A double row of large piles (Soondree) is driven across the Channel, the roots of which are well fortified with mats, fascines, and branches of trees, to prevent the earth thrown

between the double row of piles from being carried away by the flux and reflux of the tide. As a still further precaution I intend to sink across the Channel four or six condemned Native Boats, of the largest burthen, filled with earth and any heavy substance procurable on the spot—which will act as an additional support to the piling.

Secondly.—The excavation of the *Bhowaneepoor Canal*—10,000 feet in length. Upon this work, it will be necessary to proceed with considerable caution, to prevent its being left not excavated to the full depth, as happened to the Bayleygunge Canal in 1823. In order to prevent the recurrence of such an evil, (although I shall make every effort to complete the whole) if any unforeseen difficulty or great sickness should disappoint me in the number of labourers I may be able to procure, I shall take the precaution to assign them a quantity of work proportioned to what they can finish without difficulty.

Thirdly.—*The Canal traced out in Sketch No. 4. D. between Chultabarya and Baminghatta*, being in length 5 miles; and *some little expense necessary to complete the Chultabarya Canal*. The latter 2 miles of this new line are through a tract of low, jheely, mangrove jungle, which it may be necessary to prepare previous to excavation. I insert the whole 5 miles in the Estimate for the year, and shall make every effort to complete the whole. In case however this is not in my power, I shall be able at all events to open the communication with Baminghatta by finishing to D, on the Bearta Khal.

Fourthly.—*The conduct of the Dredging operations, and the construction of any new Dredging machinery* that may be ordered by the Committee to assist and expedite the scouring of the Lake Channel—which cannot otherwise be completed in another season.

The fifth object will be *the contrivance of some economical machinery for the facilitating the means of emptying the great quantity of water* which is found in excavating such Canals as the Bhowaneepoor, Bayley Gunj, or indeed any place which has previously been subject to daily inundation.

The present method of raising this water by basketing, is expensive, harrassing, and very ineffective; the work would therefore be greatly facilitated if any more perfect method were at my disposal.

I cannot immediately propose any specific plan upon this subject, as I wish it to be economical, and that the expense upon it may be covered by the rate of excavating per mile—I shall therefore make every search for pumps, or other engines, which may be procurable in Calcutta, and report to the Committee my having obtained any thing fit, and upon the method of applying them to the object in view.

The quantity of Canal to be excavated during the season, would, I imagine, warrant the expenditure of 2 or 3,000 Rs. on this head—which would not be thrown away, inasmuch as the pumps would still be serviceable.

Lastly.—I have the honour further to remark here, upon the difficulty experienced to the work for want of some convenient place for store-room and work-shops, upon the Eastern Canal. I have been hitherto obliged to hire a small Hut, the rent of which has been charged in my monthly Bills, for the expenses of the Eastern Canal.—Smiths' and Carpenters' work has, by the indulgence of Captain Baker, been conducted in the Allypoor Yard, where, at present, all the tools and materials, except fowrahs and axes, still remain. At present, while the work is proceeding in the Lake, the distance to Allypoor is found exceedingly inconvenient—and as the wear and tear of the Dredging Boats generally requires a forge constantly at work, it will be necessary to have some convenient place in their neighbourhood—and I have therefore to request the sanction of the Committee to my hiring such, until their proceedings in purchasing ground, place at my disposal a spot and building adapted to the purpose.

No. 81. *f.*⁽¹⁾*Estimate to accompany the proposed Scheme for operations during 1827-28.*

1st Item,—Dam across Kulloar River, &c., being the residue of			
Item in expense of last year,	7,207	9	7½
2nd Ditto,—Bhowaneepoor Canal, 2 miles, @ 10,000 Rs. per mile,	20,000	0	0
3rd Ditto,—Baminghatta Canal, 5 miles, @ 10,000, Rs. ditto, ...	50,000	0	0
Add expenses required upon Chultabarya Canal and old			
Nullah,	3,000	0	0
4th Ditto,—Dredging operations, Estimate for 12 months, ...	4,000		
Probable expenses attending Mr. May's machinery which will			
have to be debited to Canal Department up to October, ..	3,000		
Construction of a new Dredger,	8,000		
Working the same for 8 months,	2,400		
	————	17,400	0 0
5th Ditto,—Construction of any Hydraulic Engines to assist excava-			
tions, part of which will be hereafter deducted, by			
gain in rate per miles of excavation,	3,000	0	0
Total Sicca Rupees,	1,00,607	9	7½

CANAL SUPERINTENDENT'S OFFICE :

28th August, 1827. (Signed) THOMAS PRINSEP, *Lieut. Engrs.*

(True Copies,)

J. N. JACKSON,

Secretary Canal Committee.

(No. 82. and No. 83. omitted.)

No. 84.

Extract of a Letter dated 10th September 1827, from the Secretary to the Canal Committee to H. T. PRINSEP, Esq., transmitting with Observations the Paper marked No. 81. and its inclosures.

[SOONDURBUN CANALS]

"The great reduction which that Officer has been able to effect in the length originally deemed necessary for this portion of the Scheme, must be deemed highly satisfactory; both as regards the diminished length of the space to be excavated and the great saving in expense that will consequently follow.

"The line according to the original survey measured $21\frac{1}{2}$ miles, to complete which, the sum of Rs. 2,10,000 had been assigned. By a recent and more accurate examination of the Country, however, Lieutenant Prinsep has ascertained that the length will not exceed $14\frac{1}{2}$ miles; which he calculates may be completed for about Rs. 1,50,000, leaving Rs. 60,000 to be appropriated as may hereafter appear necessary.

"6th. Lieutenant Prinsep purposes during the season to open the communication along the whole of this line, thereby rendering it fit for the purposes of the Eastern Trade."

Works.	Sums Estimated.	Sums Expended.
Constructing a Dredging Machine,	4,304 0 0	4,494 1 3
Working a ditto ditto,	1,000 0 0	.. .. .
Excavations Chaltabarya Canal, 15,000, including an after grant, say 5,000,	20,000 0 0	19,229 12 11
Clearing and bunding from Bayleygunj to Chou- mooh,	7,500 0 0	3,231 9 7 $\frac{3}{4}$
Hoseinabad Cuts and Kullour Dam, 10,000, excluding amount carried to Chal- tabarya Canal as above,	5,000 0 0	2,792 6 4
Deepening, &c. &c., Balleaghaut Canal,	4,903 $\frac{1}{2}$ 0 0	4,982 6 3

(No. 85. omitted.)

No. 86.

To MAJOR JACKSON,

Secretary to the Canal Committee,

27th September, 1827.

SIR,

I am directed by the Right Honourable the Vice-President in Council to acknowledge the receipt of a Letter from you, dated the 10th instant, together with the detailed Report and Maps submitted by the Superintendent of Canals in explanation of the result of his operations in the past season, and on the works proposed for the ensuing year.

2. His Lordship in Council sees every reason to be satisfied with the progress made by the Superintendent of Canals in the past season 1826-27, and has accordingly passed the undermentioned Bills submitted by him for expenses incurred in the various works subject to his superintendence in the month of June last, viz.—

Bill No. 32 for Expense of Balya Ghaut Canal,	Rs.	480	11	5 $\frac{1}{2}$
„ „ 33 „ Expense of a Dredging Machinery,	752	4	10	
„ „ 34 „ Expense of Chultabaria Canal,	6,000	5	6 $\frac{1}{4}$	
„ „ 35 „ Expense of Bayleygunge Canal,	151	11	10 $\frac{1}{4}$	
„ „ 36 „ Expense of Bhowaneepoor Canal,	70	0	0	
„ „ 37 „ Expense of Kullooar Nullah,	21	0	0	

3. The several Abstract Statements (Nos. 1 to 5) of estimated and actual expense of the works mentioned in the 2nd paragraph of your Letter having been found correct, are, as recommended by the Committee, passed by Government.

4. The success of the Dredging apparatus is considered very satisfactory, and warrants the recommendation that a similar apparatus, capable of being fitted on to Native Boats or on others, if procurable, should be prepared, His Lordship in Council therefore sanctions the disbursement of 8,000 Rupees for this object.

5. The proposed works for the ensuing season, besides prosecuting the Dredging, which, including the New Boat, is estimated to cost 17,400, are as follows—

6. i, The Dam of the Kullooar estimated cost 7,207.—2nd, The Bhowaneeepore Canal 2 miles, 20,000 Rs.—3rd, The Bahmunghatta Canal, from Cheltabarcea to the Salt Water Lake Outlet, 5 miles, 50,000 : but this last mentioned work the Superintendent doubts being able to complete for the whole distance, in which case the line will be carried to a Channel somewhat more than half the distance, so as to leave the navigation open, as the result of the works of the season. To this object, His Lordship in Council concurs with the Canal Committee in attaching very great importance. He accordingly sanctions the works above described being undertaken at as early a date as possible. His Lordship in Council further sanctions the expenditure of 3,000 in improving the Cheltabarcea Canal and old Nullah, and 3,000 for the construction of Hydraulic Machinery to keep works clear of water. This latter charge, as it will diminish the cost of excavation, will produce a corresponding saving in the rate estimated per mile as above stated. The total estimate for the year, not reckoning this saving, will be 1,00,607, for this part of the new line of Canal.

7. His Lordship in Council cannot refrain from noticing favourably the ingenuity and science displayed in the application of the principle for producing a current to deepen the Channel of the Canal, when the bed reaches the oozing sand. This is conspicuous in the management of the Cheltabarcea Canal, and His Lordship in Council hopes that similar means will be found of overcoming this grand obstacle in the lines remaining to be excavated.

8. The observations of the Superintendent and of the Committee, in regard to the state of Tolly's Nullah, and the increasing difficulties of that passage, have struck His Lordship in Council forcibly, and, combined with the prospect that the rest of the new line will be completed this season, point to the necessity of preparing by the purchase of ground, for the speedy commencement of the Ooltadanga line between the Hoogly and Salt Water Lake.

9. It appears that your purchases in the past season have been very limited in consequence of the prohibition to make payment otherwise than in notes for two years, bearing 5 per cent. interest.

10. In full confidence that expedition in the purchases will be a measure of ultimate economy, and that much of the outlay will be recovered by resale of the ground not required for the Canal, His Lordship in Council consents to remove that restriction, and to authorize the completion of purchases for cash to the extent of 3 Lacks of Rupees in the present season.

11. A Treasury order will accordingly be issued in favour of the Committee to the Sub-Treasurer, to enable him to meet the drafts of the Committee for the purpose in question.

12. The Superintendent of Canals is authorized to continue the two Sircars entertained by him for Mofussil duties, at an expense of 66 Rupees per mensem, for such period as he may require their services, and to employ F. Mullins, as an Overseer, with a Salary of 30 Rupees per mensem from 1st of July last. The pay of these to be disbursed in the same manner as the present Establishment.

13. His Lordship in Council will be prepared to sanction the permanent employment of a practical Mechanic on the establishment of the Superintendent as soon as Lieut. Prinsep may meet with a steady person properly qualified for the duty.

14. The original Plans and Bills which accompanied your Letter are herewith returned.

I am &c.,	
(Signed)	HOLT MACKENZIE,
	Secretary to Government.

(No. 87. to No. 95. inclusive, omitted.)

No. 96.

No. 112.

To MAJOR J. N. JACKSON,

Secretary to the Canal Committee.

SIR,

I have the honour to Report to the Committee, for the information of Government, that I have been under the disagreeable necessity after unremitting exertions, to prevent much disappointment, of abandoning as hopeless, the operations for closing the Kulloar Salt River, during the present season.

The Committee are already aware of the chief difficulties attending the undertaking—viz. the great depth and section of the water-way; the rapidity and great rise and fall of each tide; the nature of the soil from which the earth has to be excavated; and the locality of the place, two miles within the limits of uncultivated jungle.

Other difficulties in the unusual drought of the present season, the dreadful prevalence of Fever and Cholera Morbus (from the latter of which 43 cases out of 80 terminated fatally among the coolies at Hoseinabad alone,) and added to the above, have proved fatal to my endeavours, and I am at present without hope to retrieve the loss during the remaining month of May, or indeed, if this were possible, to secure the new made earth from falling away during the rains which are so near at hand.

My intentions to complete the work, between November and February, were frustrated by the reluctance of the Coolies to work in the Jungle, while any other employment could be procured—and until the crops of the district were wholly collected in January, the number of Coolies collected, notwithstanding large advances, was barely sufficient to prepare the ground for excavation and collect materials; during the month of February, the work proceeded rapidly, although the number of Coolies still disappointed my expectations. In the first neap tides of March, the Dam was so far advanced, as to give me every hope of completing it in the following neap tides, if additional Coolies could be collected. From the 15th March to the present moment, the Dam appears to have progressed very insensibly. The number of Coolies in place of 2,000, have varied between 700 and 300. It has been found impossible to exceed this number, and difficult to keep this number upon the work.

The undertaking is of that nature, that during its last stages in particular, its success entirely depends upon the unremitting exertions of a number of men, not less than 2,000, any falling off from which, must defeat the object and create the loss of their labour.

I have therefore under the circumstances, thought myself not warranted to incur any further expense during the present year.

The Committee are aware of the chief reasons which have rendered it necessary to keep the mouth of the Hoseinabad Canal closed, until some provision could be made to secure the neighbouring district from the injuries stated in the petition of Kaleenat Roy, Zemindar of the Purgunnas Myhuttee and Burreedhuttee. I have now to request instructions whether under existing circumstances it is thought advisable to excavate the mouth of that Canal, or await the result of a second attempt during the approaching year.

I have held communication with the Zemindar in question, who, although urgent for the Dam, appears unwilling to make any sacrifice of money to procure it, and have pledged myself, that no more than the necessary preparation shall be made for opening the mouth of the Hoseinabad Canal until the 15th instant, by which time, he will definitely state the extent to which he is able and willing to assist me in a second attempt to close the Kulloar Gung, in assuring the attendance of a sufficient number of men,

and what sacrifice he is ready to make to reimburse the Government, in case the expense of a second attempt prove fruitless.

The Zemeendaree of Kaleenot Roy, is the principal, although not the only country liable to injury from the admission of the salt water of the Kullooar into the River. The injury to be apprehended is not to the low lands or crops, but to the supply of drinking water, and a fancied unhealthiness to be apprehended from the proximity of salt water.

The expenses already incurred upon the work, will have attained 12,000. The accounts are not yet closed. I estimate a second attempt at not less than 15,000 Rs.

I will, without delay, apprise the Committee of the final answer of the Zemeendars as to the extent to which they are able and willing to assist in a second attempt, and have to request an early consideration of the subject, in order that in case the Governour General in Council does not deem it expedient to renew the undertaking at the sole risk and expense of Government, and that the Zemeendars prove unwilling to share either the risk or expense; I may be able to complete the excavation of the 250 feet of Canal, at the mouth of the Hosseinabad Canal between the 15th instant and 1st proximo, after which period it will become difficult.

I have only further to add my still firm conviction, that although the undertaking must by its nature, be attended with great uncertainty as depending so much upon the constant and unremitted labour of so large a body of men, (which I have found it impossible during the present unfavourable year to collect or keep together,) that there is no real impossibility in the undertaking, and that this point, the cause of the present failure, being set at rest, by the assurance of the Zemeendars, who are able, when willing, to insure the attendance of their ryots; I have little fear of the result.

I have, &c.

HOSEINABAD :
3rd May, 1828.

(Signed) THOS. PRINSEP, *Captain Engineers,*
Superintendent of Canals.

No. 97.

No. 56.

To CAPTAIN T. PRINSEP,
Superintendent of Canals.

SIR,

I am directed by the Canal Committee, to acknowledge the receipt of your Report of the operations connected with the Kullooour Dam, dated the 3rd instant, and to intimate to you, that the Committee will postpone submitting it to Government until you shall have ascertained and communicated to them, the final determination of the Zemeendars regarding the extent of the aid, which they would afford you, in the event of a second attempt being made to complete the Dam, and to request, that this information may be furnished at your earliest convenience.

I have, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA :
8th May, 1828.

(Signed) J. N. JACKSON,
Secretary Canal Committee.

No. 98.

No. 117.

To MAJOR J. N. JACKSON,

Secretary to the Canal Committee.

SIR,

With reference to my former Letter, No. 112, of 3rd instant, and your favour No. 56 of the 8th instant, in reply I have the honour to state, that the interval agreed on between myself and the Zemeendar, Kaleenat Roy's Agents, for them to determine to what extent they are willing to assist in a second attempt to close up the Kulloowar Gunj, has expired, and although they appear still urgent upon the subject no document has yet been submitted by them, as therefore it appears to me, that their chief object is to create a delay that may render it impossible to excavate the mouth of the Hossynabad Canal during the present season. I beg leave to submit with deference to the Committee, the propriety of soliciting the orders of the Governor General in Council upon the subject, without further delay. The Zemeendars will probably come to a more speedy decision, when they find the subject under the immediate attention of Government, and should their answer be favourable, I will lose no time in forwarding the petition.

I have, &c.

SUPERINTENDENT OF
CANALS' OFFICE:
19th May, 1828.

(Signed) THOS. PRINSEP, *Captain Engrs.,
Superintendent of Canals.*

True Copies.

J. N. JACKSON,
Secretary Canal Committee.

No. 99.

No. 68.

To H. MACKENZIE, ESQ.,

Secretary to Government.

Territorial Department.

SIR,

I have the honour by desire of Canal Committee, to transmit for the information of Government, a copy of a Letter from Captain T. Prinsep, Superintendent of Canals, dated the 3rd instant, reporting his having been reduced to the necessity of abandoning for this season, the operations which he had commenced, with every prospect of ultimate success, for closing up the Kulloowar Salt River, near the point where it is intersected by the line of Canals constructing under his superintendence.

The Committee have delayed bringing this subject to the notice of Government, until they had ascertained by a second Report from Captain Prinsep, dated the 19th instant, (a copy of which, as also of my letter to which it is a reply, I have the honour to annex) how far it would be practicable and expedient, to make another attempt this season, towards completing the Dam, with the assistance which Captain Prinsep anticipated would be afforded him, by certain interested Zumeendars, who had entered into treaty with him apparently for that purpose.

As it appears, however, from Captain Prinsep's last communications, that any renewed efforts to complete the work before the rains have set in, must be made entirely at the expense of Government, the Committee are decidedly of opinion, that it would not at present be justifiable to incur the risk of further pecuniary loss, by attempting to prosecute the work.

Before the approach of the ensuing working season, the Committee will be prepared to offer for the consideration of Government, the result of their deliberations relative to the expediency or otherwise of reconstructing the Kullooar Dam.

In submitting Captain Prinsep's Report, the Committee are anxious to express their opinion, that the failure of the attempt to construct the Dam this season, has arisen entirely from circumstances over which that Officer could not possibly exercise any controul, some of these are enumerated in Captain Prinsep's first Letter, and the Committee in adverting to them feel assured, that Government will exonerate from all blame, an Officer, who on every occasion coming under this Committee's observation, has manifested the most meritorious zeal and perseverance, at the risk of his health, arising from constant personal exposure.

I have the honor to be,

Sir,

CANAL COMMITTEE'S OFFICE, CALCUTTA :
22nd May, 1828.

Your most obedt. Servant,
J. N. JACKSON,
Secretary Canal Committee.

No. 100.

(No. 119.)

TO MAJOR J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

I have now the honor of forwarding the petition of the Zemindars of Myhattee and Augurpara Purgunnahs. As the subject of the extent of injury likely to occur upon opening the Hoseinabad Canal to the adjoining district has already been fully expatiated upon by Major Schalch, in his correspondence in the years 1823-24, it would be superfluous to enter into any further explanation.

The petitioners magnify the danger, and perhaps their terrors are natural with the view of what has happened in their immediate neighbourhood to the Dholyapoor Purgunnah, by the influx of salt water through the new cut excavated by the late Lieut. Morrieson of Engineers, in the year 1812 or 13. The relative local circumstances of the district will guarantee them against any such general injury ; indeed there are few tracts of low ground, in the two Purgunnahs named, which are not above the influence of any high tides during the months of March to June.

The parties petitioning, notwithstanding their professions to me personally, appear after a more mature consideration unwilling to make any sacrifice to gain their objects, or to share any portion of the risk of failure that must attend such a work, and their offer of assistance is too inconsiderable to allow me to reckon upon any greater advantages than I possessed during the present year. The number of Coolies I consider indispensable to the success of the work is 2,000, or upwards. I shall therefore still have to collect from a distance 12 to 1500, and as all other Zemeendars within 5 to 10 miles, are indifferent upon the subject, desertion from sickness or unwillingness to work at so unfavourable a spot, may place me in the same circumstances that have caused the failure of the present year.

I have, &c.

CALCUTTA, SUPT. CANALS' OFFICE :
30th May, 1828.

(Signed)

THOS. PRINSEP, *Capt.*
Superintendent of Canals.

No. 100. a.

(Translation.)

To CAPTAIN THOMAS PRINSEP,

Superintendent of Canals.

The Humble Petition of Kaleenauth Roy, &c. &c. Talookdars Purgunnah Augur Parrah, Myehattee, &c. in the Jurisdiction of the 24-Pergunnahs.

Your Petitioners most respectfully beg leave to submit to your Honour, that when Major Schalch issued orders to open the mouths of the new Canal of Hoseinabad, they having foreseen the danger, wrote him a petition stating that without first shutting up the mouths of the Salt Water Lake, the union (being lengthened of the new Canal with the River Jumna,) would occasion a considerable Lona Shakestee and the Ryots (their periodical produce of vegetables being destroyed) would consequently suffer an inevitable ruin. The people and beasts live by drinking the River (Jumna) water and if the water of this River be impregnated with Salt, of course not a man would be in existence on account of fresh and good water, and these well cultivated Lands would be desolated, as well as those places that contain the habitations of your petitioners.

Major Schalch having from ocular demonstration taken this serious matter into his consideration, and having likewise foreseen the fatal consequences of such a measure, recommended a compliance with the request of your petitioners on his making a Report to the Governor General in Council.

Government were pleased to authorize a compliance with your petitioners' request, and desire Major Schalch to have (in the first place) the mouths of the Salt Water Lake shut up, and then open those of the new Canals.

Your petitioners enjoyed peace from the issue of this order down to the present time, when your Honour has lately sent Coolies to open again the mouths of the Canal.

Should the new Canal be extended without previously stopping the mouths of the Salt Water Lake, there is no doubt of the total destruction of the Pergunnahs and an interruption to the habitation of people in general.

For the reason above assigned, your Honour will be graciously pleased to shut up the mouths of the Salt Water Lake and then begin extending the mouths of the Canal in question, for the benefit of the Country as well as for the health and comfort of your petitioners.

If the want of Coolies is complained of, your petitioners are ready (for this transaction) to provide with 7 or 8 hundred Coolies on their being paid from your Treasury.

The 11th Joistee, 1235, Bengal.

No. 101.

To SECRETARY CANAL COMMITTEE.

Revenue.

SIR,

The 29th May, 1828.

I am directed by the Honourable the Governor General in Council to acknowledge the receipt of your Letter, dated the 22nd instant, with its enclosures, relative to Captain Prinsep's operations connected with the Kulooar Salt Lake, and to communicate as follows—

2. The failure of the undertaking must of course occasion regret and disappointment; but nothing seems to have been wanting on the part of Captain Prinsep, whom the Governor General in Council therefore exonerates from blame. In considering, however, what is further to be done, it appears to the Governor General in Council, that all thoughts of renewing the attempt at the expense of Government must be relinquished; and it seems

to be very unlikely that the parties interested will agree to bear the charge: since besides the uncertainty of success, the object in view (a supply of fresh water) can probably be better and more cheaply attained by constructing Tanks. Now to keep the mouth of the Hoseinabad Canal closed during another rainy season, will, it is understood, occasion considerable inconvenience and expense; and unless therefore the parties above referred to, have, or immediately do, come forward with some distinct proposal satisfactory to your Committee and to Captain Prinsep, the Governor General in Council is of opinion, that that Officer should be authorized to excavate the mouth of the above mentioned Canal without delay.

I am, &c.

(Sd.) H. M.

[*Secretary to Government, Territorial Department.*]

No. 102.

No. 130.

TO CAPTAIN J. N. JACKSON, A. Q. M. G.

Secretary to the Canal Committee.

SIR,

Having now closed the operations of a second season, I have the honour to submit my observation upon the different objects that have engaged my attention, and my remarks upon the scale of expense with which they have been attended.

2. In the scheme of operations submitted in my Report of last August, although I included in my estimate the whole length of Canals required at Bhowaneepeer and Bahmunghatta, to open a new line of communication between the Salt Lake and Eshamuttee: I then expressed some doubt of my being enabled to complete the whole in one season on account of the difficulties that usually attend excavating through a tract of jungle, in collecting and retaining great number of workmen in places so remote from their houses, and so destitute of every comfort and necessary to their health and subsistence. The very unusual insalubrity and drought of the present dry season, has occasioned much greater disappointment in the progress of the works than I could have anticipated under any possible circumstances.

3. I have been unable to complete either of the Canals at Bhowaneepeer or Bahmunghatta, besides the unfortunate failure of the Dam across the Kulloor Gong, which may be ascribed with justice to the same cause, and there will remain a length of upwards of $3\frac{1}{2}$ miles of Canal to excavate in the approaching season before the new line of navigation can be opened to the trade of the Sunderbuns.

4. In the General Abstract of Expenditure which accompanies this Report, it will be seen, that I have left undrawn a large sum* of the assignment granted for the expenditure of the season, and that there remains as balance, partly in hand and partly to be recovered from the different contractors, a farther sum to stand over to the approaching year.

* Sa. Rs. 26,000.

5. The result of the present year's proceedings has impressed me more than ever with the truth of the remark I had the honour to make upon the method of conducting Canals under the circumstances of those at Bhowaneepeer, and the last 2 miles at Bahmunghatta.

6. In both these districts, the population of the immediate neighbourhood is engaged in the manufacture of Salt. Tanks of fresh water are scarce, and barely sufficient for the subsistence of the inhabitants; who, in very dry seasons, are left dependant upon a few shallow pools of muddy and half brackish water—under such disadvantages, it appears to be indispensable to the economy and success of the undertaking to conduct the excavations

slowly and cautiously, assembling only such numbers of Coolies as I can provide with the means of living with some degree of comfort; and with this view (as also that they may be under my own superintendence rather than of a contractor,) I shall henceforward with the approbation of your Committee, work with daily Coolies upon a daily measurement of work done as at Bhowaneepoor during the present year; a method which secures me against any portion being left imperfect, at the close of the season, besides not being attended with any great additional expense.

7. The arrangements which I have made to ensure a supply of fresh water to the works will, I trust, enable me to finish the remainder of the line of Canals required for the new route between the Lake and Hoseinabad, with the exception of the Canal alluded to in my last year's Report, and described in the Plate No. 3 C. accompanying that Report by the letters X. Y. upon which I could not commence until the Bhowaneepoor Canal is finished.

8. The Committee may not, without some justice, consider that the aggregate of work executed during the two seasons, bears a very unequal ratio to the expense of the whole Canal Establishment; such is also my own view, and I cannot therefore refrain from hazarding a few remarks in explanation of the causes.

9. In the first place, of the funds sanctioned for the executive part of the undertaking, a moiety only has to be expended upon the works Eastward of the Salt Water Lake. From the extent of Country over which this work has to be conducted; from the various local difficulties, (the part commenced being the most difficult and precarious of the whole undertaking) and the caution necessary in superintending such work at many distant places, I have been obliged to proceed more leisurely and cautiously than could have at first been wished, to prevent a total failure and great loss which might have been entailed by embarking too precipitately in such work.

10. The remaining half of the funds are to be expended upon a work (the Circular Canal) of by far greater importance and also easier execution; the progress of which can in no way interfere with the Mofussil operations.

Upon this portion of the undertaking, I have as yet made no commencement, the ground not having been at my disposal.

11. The two late seasons therefore which might have brought this important part of the undertaking to such a state of forwardness, without detriment to the progress of the rest, may be said to have been lost to one-half in point of time, and it cannot therefore be wondered at, that a proportionate addition to the original contemplated expense on such head, and delay in completing the work, should occur.

12. Although the purchases contemplated at the beginning of the year are still not effected, I am happy to say that there appears to be a prospect of a good portion of the line being placed at my disposal in a few months; and that I shall be able shortly to proceed in my yearly labours in a more satisfactory way to myself and my employers.

13. The Committee knowing the very superior importance I have always attached to the Circular Canal, in the ultimate advantages that are to be expected from the whole scheme of Canals proposed by my predecessors, will not be surprised at my having watched with more than common anxiety the progress of these purchases conducted by their own establishment. The members of the Committee appear very justly to hesitate to enforce the Regulation of Government, regarding the occupation of land for such purposes, if the negociation can be conducted by any other means, and reserve it as a last resource.

14. In the Resolutions of Government, Territorial Department, of 20th March 1823, paragraphs 13 and 14, from which perhaps this hesitation has originated, the line is carefully drawn between the purchase of property which is indispensable to the work itself, and of property to be purchased with a view to profit on the resale, and only of a second-

any consideration in the undertaking. It appears to me that unless other means are procured of disposing of the earth of excavations, the whole breadth allotted of 400 feet is absolutely indispensable to the Canal, and that it would be impossible to carry it on in a narrower space. In the list of properties which I had the honour to forward with my Letter of November 9th, 1826, and upon which, with a few deviations, I believe the proceedings are conducted, I carefully limited myself to this space, and even omitted some properties, the parts of which intruded into that space whenever the property marked for purchase on the opposite side, afforded an equivalent vacant space to make up the deficiency.

15. I believe, moreover, that the chief difficulty and delay has occurred in treating with those proprietors whose grounds are more directly necessary, as in the case of the lot No. 31, of Letter E., and I have therefore more particularly felt alive to the necessity of enforcing the regulation in one or two such cases in which there cannot exist a shadow of injustice. It has also ever been my impression, that an arbitration equitably and fairly conducted would award even a less price than any obtained by negociation.

16. The papers relating to the design for the Circular Canal, still want the final sanction of the Governor General in Council, being yet in circulation among some individuals, whose opinion it has been thought advisable to obtain. This will not, I trust, create any extra delay, and the Committee will, I am confident, second my great anxiety for embracing, some portion at least, of this work in my operations during the approaching season, unless circumstances place it wholly out of their power.

17. I now proceed separately to the several works which have been conducted by me during the season, to which I have added a scheme for the approaching years' operation, accompanied with an Estimate of the Funds required for the purpose. The remarks are accompanied by one Plate No. 5 E. which I have to request may be forwarded in original, with the remarks when forwarded for the inspection of the Governor General in Council. I have also to request, that the original Plate No. 3 No. C. of last year, showing the Bhowaneeppoor line, remaining in your Office may be forwarded in illustration of the remarks upon that Canal; also Plate B. in illustration of the remarks upon the state of the Chaltabarya Canal.

I have, &c.

CALCUTTA, SUPT. CANAL'S (Signed) THOS. PRINSEP, *Captain Engineers,*
OFFICE, *Superintendent of Canals.*
22nd August, 1828.

No. 103.

No. 110.

To H. MACKENZIE, ESQ.,
Secretary to Government, Territorial Department.

SIR,

I have the honour by desire of the Canal Committee to submit herewith, for the information of the Right Honourable the Governor General in Council, a Letter from Capt. T. Prinsep, Superintendent of Canals, dated the 22d ultimo, with annexed Reports of his operations on the Eastern line of Canals, during the seasons 1827-28, and on other works of a minor description connected herewith, upon which, during that period, he has also been engaged.

These Reports are accompanied by an abstract Statement shewing the total sum drawn on account of the several works collectively, and the amount expended on the particular branches which were either completed or commenced upon during the season. Also, a list of outstanding Balances and Plans, and Sections of three principal works upon which Captain Prinsep has been employed.

The Committee in bringing these Reports and Plans to the notice of Government, have to remark, that the operations of the past season generally have not been attended with that degree of success which they had hoped for, but when the unfortunate train of circumstances detailed by Captain Prinsep, are taken into consideration, it will at once appear evident, that, the causes, which tended to retard the progress of the several works were such as no human foresight could have guarded against. The Superintendent has in his statements evinced the greatest candour, and the Committee think it due to him to say, that the fair and open manner in which every thing is described, is as creditable to him as the zeal, ability, and perseverance he has uniformly displayed in the conduct of the important duties entrusted to him.

The Committee had expected in the course of this year, to have witnessed the completion of the whole line of Canal between the Salt Lake and the Eeshamutty River, and the consequent benefit to the Eastern trade, which would have resulted from this safe and direct approach to Calcutta, being thrown open to Boats which are now compelled to resort to the circuitous and dangerous Nullahs, forming the old navigable track through the Sunderbunds; but from the Report submitted by Captain Prinsep, they learn, that about $3\frac{1}{2}$ miles of the new route still remains untouched, chiefly along the lines of the Bamingatta and Chultabarya Canals.

In the margin is inserted, a List of the works which have engaged the attention of the Superintendent throughout the season, and the Committee will proceed to notice them as there arranged.

1st. Dredging operations and Machinery.

2d. Bahamingatta Canal between Goanamagee and Kantatulla.

3d. Chultabarya Canal and works connected with it.

4th. Bhowaneepore Canal.

5th. Kulloor Dam.

6th. Eastern or Entally Canal Roads, and other miscellaneous works.

1st. DREDGING OPERATIONS AND CONSTRUCTION OF MACHINERY.

The Dredging of the entrance to the Balya Ghaut Canal and Channel through the Salt Lake, has been carried on in a very satisfactory manner; an increased depth of from one and a half to two feet, in this passage, is already perceptible, excepting at one point where the soil has been found of a harder nature than elsewhere, extending to a length of about 300 feet, but with the aid of the new Dredging which has now been brought into use, the Committee are led to expect that in another season, this Channel will be sufficiently deepened to admit of the free navigation of it by Boats of the largest class.

The expenses* of maintaining the Establishment and workmen attached to the apparatus, and purchasing a new Boat to replace one that

* Amount actually expended,	4294	12	5 $\frac{1}{4}$
Ditto Estimated,	4000	0	0
Excess,	294	12	5 $\frac{1}{4}$

had from decay become useless, has in the year amounted to somewhat more than the sum Estimated.

The new Dredging Machinery has also been completed for nearly the sum† authorized by Government, and but for the unfortunate destruction by fire, of a part of this Machinery when

† Amount authorized, Rs.	8000	0	0
Ditto expended,	8601	9	3
Excess,	601	9	3

nearly completed, as communicated to Government,

in the Committee's Letter of 15th May last, they would have had the satisfaction of reporting a considerable saving in the amount assigned for its construction.

2nd. NEW CANAL BETWEEN GHOONAMAGEE AND KANTATULLA.

That part of the Bahamingatta Canal situated between Ghoonamagee and Kantatulla, (vide Plans and Section E. No. 5) of about 17,500 feet in length, has been but partially excavated, 7,000 feet having been completed and opened for the admission of the Tide, and nearly 5,000 feet between the points B. C. on the plans, have been cut to the required depth, excepting at two or three places as shewn on the Section, where the contractors have left the excavations in an unfinished state. This portion of the work, however, as well as the other partial cutting between C. and D. on the Section, had been managed by Capt. Prinsep in a very judicious way, by being converted into Fresh water Reservoirs, for the

supply of his people during the ensuing working season. The want of this most essential necessary of life having been severely felt throughout the greatest part of the past working seasons. The rate per Chowkah at which the excavations in this quarter have been effected

for two years* past affords the most satisfactory grounds for

*1826-27, 1 : 12 : 4½ per Chowkah.
1827-28, 1 : 12 : 5 ditto.

concluding that the estimated rate of 10,000 Rupees per

mile, will not be exceeded. The total disbursements on this

Canal for the season have amounted to Rs. 21,926 including a large outstanding† balance, which Capt. Prinsep states he is making great progress in recovering from defaulters on their contracts.

† Rs. 3,157 : 6 : 4.

3rd. CHULTABARYA CANAL AND WORKS CONNECTED WITH IT.

Capt. Prinsep has, on this work, been chiefly employed in endeavouring to complete what he had left in an imperfect state on the close of the season 1826-27, owing to the strata of oozing sand, which had been found in some parts of the line, at a depth of even 5 feet‡ below the high water mark of neap tides, and through which it was found impossible to carry the excavations.

‡ Vide Plan and Section B. No. 2.

The mode suggested and put in practice by the superintendent for removing this obstruction, viz. the introduction of a strong current of water into the unfinished bed of the Canal, has evidently had the effect of clearing it out to a considerable extent already, and the Committee are of opinion, that the continuation of the method will be found extensively useful. The whole line of Canal ground from the Salt Lake to Koolna being at intervals intersected by ridges or beds of the same kind of oozing sand, which it has been found quite impossible to remove or penetrate through effectually by mere manual labour.

Capt. Prinsep has expended in excavating between the points A. and B. (vide plan) of this Canal and in deepening and enlarging the Bungur Nullahs which forms a continuation of it to the Eastward, the sum of Sa. Rs. 2,550, in this charge is included, the cost of excavating 1000 running feet of the Nullah which connects the Chultabarya to the Bahamingatta Canal.

4th. BHOWANEETPOOR CANAL.

Although the excavations on this line have been carried on under Capt. Prinsep's immediate superintendence by daily workmen, a cut of only 3700 feet has been completed, owing to the limited number of workmen which it was found possible to collect or keep together on account of the unhealthiness of the season, and the consequent sickness that existed, causing a panic in the minds of the labourers which could not readily be overcome.

The rate§ at which the excavations in this work have hitherto been effected is much above what the Canal has cost in other quarters, but this would appear to be altogether owing to its being one of the most difficult portions of the whole undertaking occasioned by local circumstances.

§ 3700 feet costs
Rs. 12,233 or Rs
17,528 per mile

The unfinished portion of this Canal (6300 feet) is included in the scheme of operations for next year, and Capt. Prinsep expects to be able to complete it within the season at a rate per mile not exceeding Rs. 15,000.

5th. THE KULLOAR DAM.

The failure of the attempt made by Capt. Prinsep to construct a Dam or Bund across the Kulloor Gong or Tide Channel, has already been reported|| to Government. The Committee will therefore abstain from offering any remarks upon the subject, particularly as Capt. Prinsep has entirely excluded it from the scheme of operations, he purposes with the sanction of Government to carry into effect during the approaching season.

|| Date of Report
2nd May, 1828.

6th. EASTERN OR ENTALLY CANAL ROADS, &c., &c.

The repairs and additions to the Roads along this Canal were very urgently required, and the Committee have great satisfaction in stating that they have been executed in a manner that merits their entire approbation. The mode which Capt Prinsep has adopted for

widening that part of the Road immediately opposite the principal wood mart, where it had scarcely a breadth of 12 feet by carrying out the bank of the Canal, instead of encroaching on the huts and ground forming the site of the Bazar as at first proposed, is deemed a very material improvement on the original plan—600 feet of the Canal itself, which for a long period had been perfectly inaccessible to Boats of even the smallest burthen, have also been greatly improved, by being excavated to a depth that will admit of their now coming up its whole length to deliver their cargoes, a point of most material importance and benefit to the community at large. This latter contingency not having been provided for, the Road Estimate has been exceeded* in the sum shewn in the margin; an amount unworthy of notice, when coupled with the very great advantages that have accrued from the execution of this work.

* Estimate for repairing the Roads, .. Rs.	1,690	0	0
Amount expended on above account and deepening 600 feet of the Canal,	2,072	6	5
Excess,	382	6	5

The obstructed state of Tolly's Nullah, and the experimental measures that were proposed by Capt. Prinsep for increasing the depth of water in this thoroughfare, were brought to the notice of Government on the 15th of October last, and on the 25th of the same month, Government was pleased to authorize a trial of the plans suggested by Capt. Prinsep. The Dams and Shutters proposed by that Officer were accordingly constructed at two points on the Nullah, at a considerable distance from each other, but the very trifling benefit that resulted from the use of the Dams and Shutters justifies the entire abandonment of the plan. The Committee therefore must look to other more efficacious measures for rendering this Nullah fit for the purposes of navigation, and which they are of opinion can only be effectually resorted to when its course shall, by the opening of the new cuts, be less obstructed than at present. The actual cost of this experiment has exceeded the

† Estimate Rs.	400
Outlay,	469 2 4
Excess,	69 2 4

Estimate† by the trifling sum of Rs. 69 : 2 : 4.

The total amount assigned by Government for carrying on the Canals and other works for the past season, was Rs. 1,00,607 : 9 : 7½, of this sum Capt. Prinsep has only drawn Rs. 74,000, so that a balance of Rs. 26,000 : 9 : 7½ is available for the ensuing year's operations, and the Committee beg to recommend that funds may be assigned to the extent required by Capt. Prinsep in sufficient time to admit of his recommencing work at as early a period of the season as may be practicable.

The total amount of Capt. Prinsep's Estimate is Rs. 54,650, deducting from that sum the two items specified in the margin‡ a balance of Rs. 27,607 : 7 : 2 is exhibited, being the amount for which an additional assignment is required. The observations which Capt. Prinsep has made in the 13th and three following Paragraphs of his Letter, in allusion to the duties which fall immediately and exclusively within the province of the Committee, they cannot deem otherwise than unnecessary, and which had better have been omitted, with reference to the executive situation he holds under the Committee.

‡ Undrawn Balance of assignment dated 27th September 1827, for operations of 1827-28,	26,000	0	0
Cash Balance in Capt. Prinsep's hands,	1,042	8	10
Total available assets,	27,042	8	10
Amount of Estimate for ensuing season's operations,	54,650	0	0
Amount for which an assignment is required,	27,607	7	2

The purchase of Land along the line of the proposed Oultahdanga Canal, simple and easy as the process may appear to others, has entailed a degree of labour and anxiety upon the Committee, that they little expected, considering that the means of obtaining the Lands upon fair and equitable terms were liberally placed at their disposal, as also, the power of enforcing the surrender of particular properties, where a refractory or avaricious spirit might shew itself to the hindrance of their labours, and the ultimate retardment of the great object which Government had in view. The powers vested in the Committee by

Regulation I. of 1824, they acknowledge they were reluctant to enforce, where the most distant hope of effecting their purchases by negotiation appeared to exist, and it is not the least pleasant part of their task, to be able to assert, that with one or two exceptions the whole of the Lands purchased by them have been obtained at prices even below what had been originally* Estimated, and without the aid or intervention of the Regulation above quoted, or recourse to any measure of harshness whatever. It is doubtless true, that many and very annoying delays have occurred, owing to the combination amongst the proprietors of Land in this quarter, their proneness to litigation and chicane and their amazing ingenuity in devising Plans and subterfuges calculated to mislead and deceive the Committee's Agents and very often themselves; but it is not apparent to the Committee, that the interests of Government have suffered by this delay, for even up to the present moment, it is undecided to which of the two Plans of this most important part of the whole undertaking that have been brought to the notice of Government a preference shall be given. The Committee take this opportunity of stating that the memoir, &c., drawn up by Capt. Prinsep on this subject, has agreeably to the orders of Government of 6th December 1827, been circulated amongst persons of acknowledged scientific acquirements, who have all, with the exception of one, recorded their opinions, which opinions would ere this have been laid before Government with the Committee's final sentiments regarding them, were it not, that they are still awaiting a reply from an individual possessing high attainments, and general acquaintance with undertakings of this kind, but who has been hitherto prevented by ill health and other causes from devoting his attention to the subject, he will, however, be requested to favour the Committee with the result of his deliberations at such early period as will preclude the possibility of any delay being caused in the operations of the year.

* 60 Rs. per
Cottah.

The Committee might adduce as another and very cogent reason for the caution they have observed in resorting to the powers of the Regulation in every case where they might have done so, the circumstance of its being more than probable from the rapid manner in which the value of land has increased in and around Calcutta, that arbitrators would have awarded a considerable higher price for the lands required than the Committee has in any instance paid since the commencement of their purchases, and one such award would have entirely destroyed the Committee's hopes of fulfilling their duties in an economical and pacific manner.

An apprehension of enhancing the demand for the land not yet obtained, has operated powerfully with the Committee in inducing them to defer commencing any part of this Canal, until the whole of the required Lands should be secured by purchase; they have now, however, the fairest prospect of attaining this object in sufficient time to admit for the ground being cleared and ready for excavation next season.

The quantity purchased since the date† of their last Report, has amounted to 173 B. 12 C. 4½ C. Biggahs for which they have paid, including the value of Buildings, Rupees 2,20,836: 11: 0.

† 10th September.
1827.

There yet remains about 196 Biggahs to be obtained, but as the Committee have still funds at their disposal to the amount of Rupees 48,709: 5: 0, they will defer calling for a further assignment until they have nearly expended the sum above mentioned.

I have, &c.

CANAL COMMITTEE'S OFFICE, CALCUTTA :
8th September, 1828.

(Signed) J. N. JACKSON,
Secretary Canal Committee.

P. S. The List of outstanding balances. Abstract statement of Expenses, and Plans which accompany this Report, being all Original Papers, I am directed to request that they may be returned when no longer required by Government.

(No. 104. and No. 105. omitted.)

No. 106.

To MAJOR J. N. JACKSON,

Secretary Canal Committee.

Territorial Department—Miscellaneous, Revenue.

SIR,

I am directed by the Governor General in Council to acknowledge the receipt of your Letter No. 110, dated the 8th ultimo, together with the detailed Report and maps submitted by the Superintendent of Canals, in explanation of the result of his operations in the past season and on the works proposed for the ensuing year.

2. Though in some respects the operations of the year have disappointed expectation, His Lordship in Council sees every reason to be fully satisfied with the management of Captain Prinsep.

3. The Governor General in Council approves and sanctions the Estimate submitted by Capt. Prinsep, for the several works proposed to be executed by him during the approaching season 1828-29, amounting in the aggregate to Rs. 54,650, an order will accordingly be issued on the General Treasury in favour of the Sub-Treasurer for the Sum of Sa. Rs. 27,607: 7 : 2, to enable him to pay the same to Captain Prinsep as required by him.

Amount of Estimate	54,650 0 0
Deduct Balance in	
Captain Prinsep's	
hands,	27,042 8 10
Sa. Rs.	27,607 7 2

4. In regard to the purchase of Land in the vicinity of Calcutta, his Lordship in Council has the fullest confidence in the judgment and zeal of the Committee, whom he considers entitled to the cordial acknowledgements of Government for that, as for every other part of their labours in aid of this important undertaking.

5. The Original Papers and Plans which accompanied your Letter are herewith returned.

I am, &c.

(Signed)

HOLT MACKENZIE,

Secretary to the Government.

COUNCIL CHAMBER:

The 2nd October, 1828.

(No. 107. to No. 112. inclusive, omitted.)

No. 113.

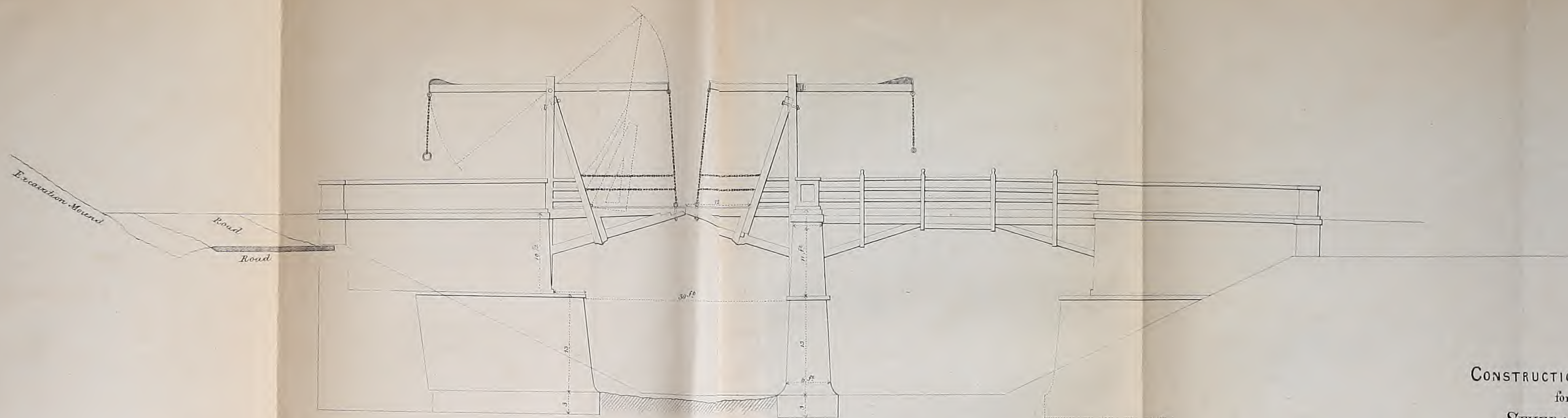
No. 159

To CAPTAIN J. N. JACKSON,

*Assistant Qr. Mr. General,**Secretary to the Canal Committee.*

SIR,

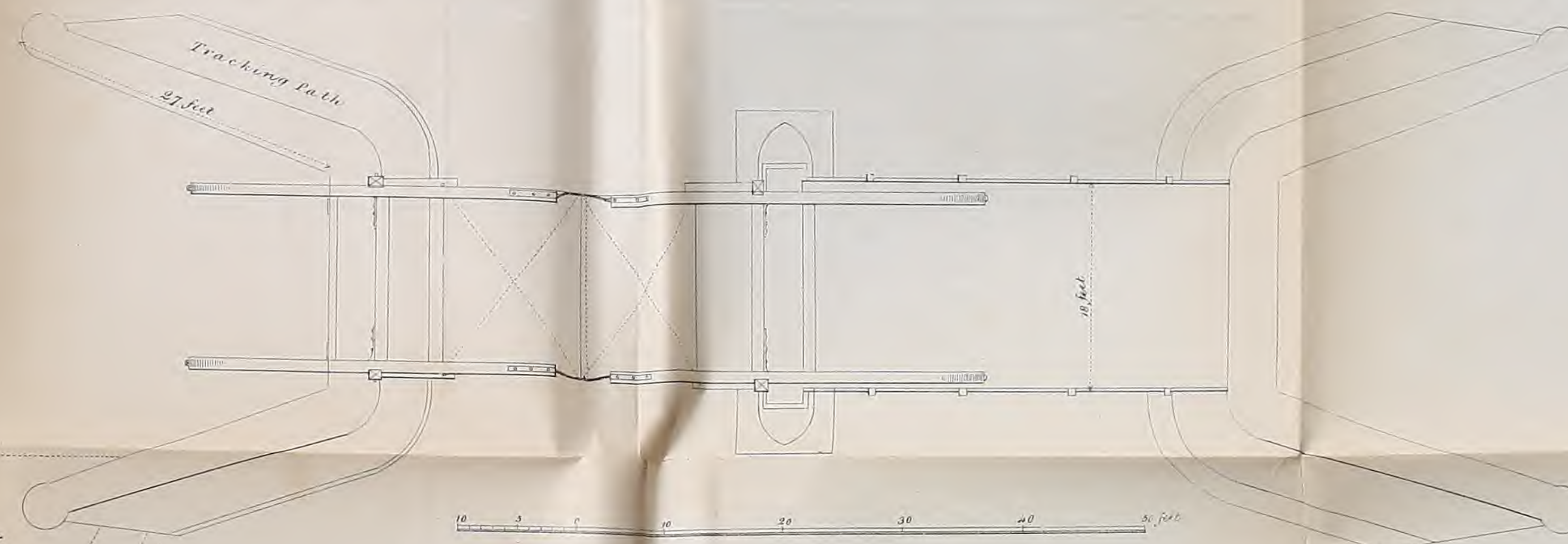
In considering the details connected with the Circular Canal now in progress, I have been induced to recast the Scheme originally sanctioned, and now remaining as my instructions, for the construction of the various Bridges that will cross the Canal. The Craft that usually Navigate the Soonderbuns and Tolly's Nulla require a great loftiness of Bridge and most of them are masted. The level of the present Roads, Sambazar, Manicktulla, Ramlochun, and Balya Ghat, will not afford sufficient height above the surface of what the Canal waters will be, without very considerable raising, which is always an objection in the approach to a Bridge.



CONSTRUCTION PROPOSED
for the
SEVERAL BRIDGES
over the
Circular Canal
in lieu of
Bridges of Suspⁿ

26th March 1829

(Signed) Thos. Phipps Esq. & Co. Eng^s

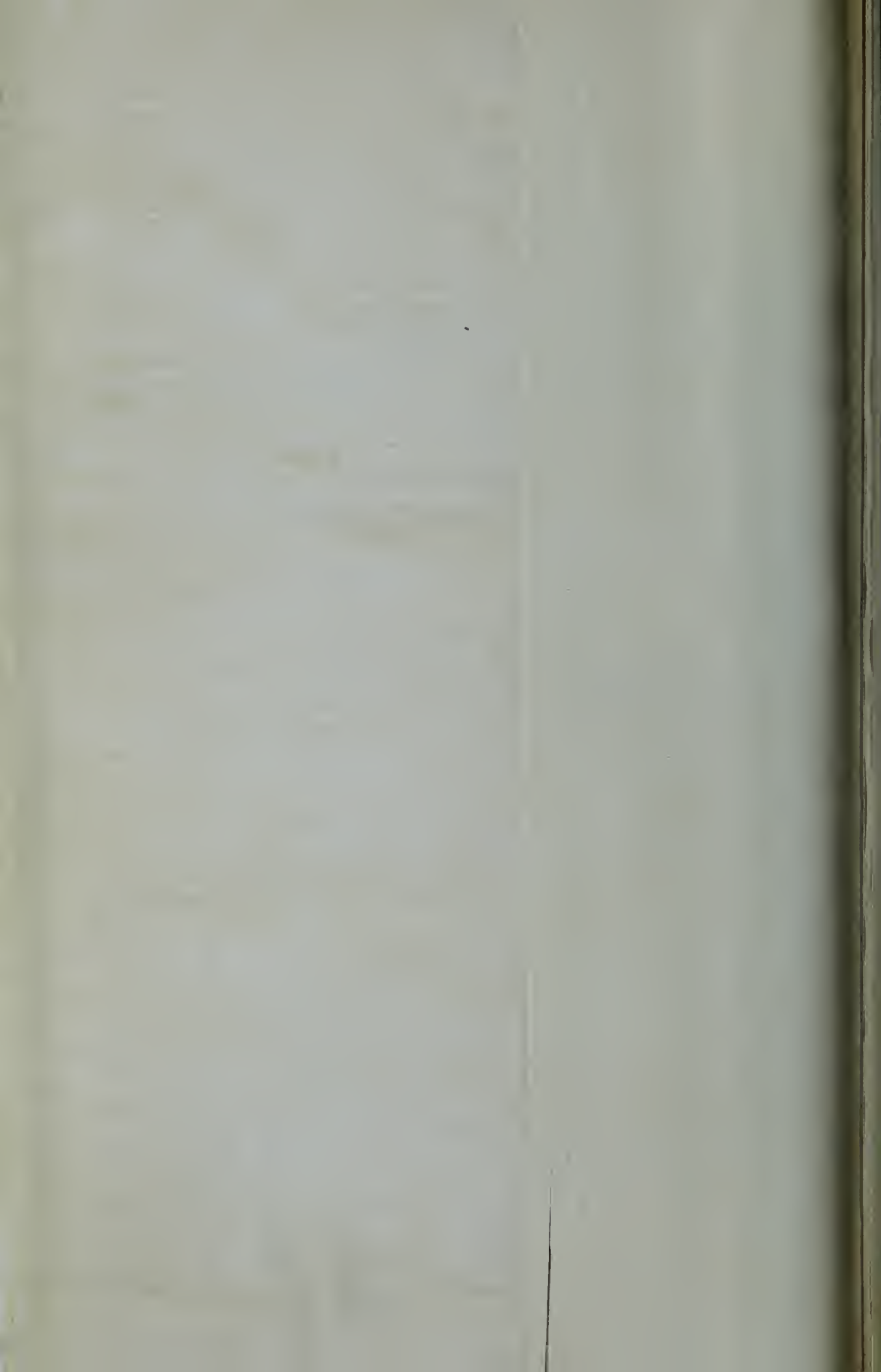


Road way

Slope

Track path

Canal Slope



It would unquestionably be a great advantage to allow every description of Craft, even rigged Pinnaces, to navigate the Canal without the necessity of dismasting or unrigging their rudders as constantly necessary with Native Boats. Upon these several considerations I am therefore of opinion, that it would be more advisable to substitute for the Suspension Bridges proposed, Draw Bridges, well balanced and readily lifted by a single hand.

I have the honor to forward a Sketch* of some such mode of construction as will probably be thought most fit for the purpose. The design leaves two clear water-ways of 30 feet each, and tracking paths under the Bridges. One of which is made to lift with a double flap, the other to remain a standing Bridge of timber. The design will not require the Road levels to be raised above their present standard more than 4 or 5 feet at most. The expense of such a Bridge will be even less than one of Suspension, besides its being easy of repair.

If the Committee concur with me upon the superior advantages of such a mode of construction, which I understand is the most usual in Holland, where inland communication is almost entirely carried on Canals, I have only to request, that it may be brought to the earliest consideration of the Government; that, if possible, I may be enabled to commence the foundations of the two first during the month of April of the present year.

* This Sketch is in the Office of the Military Board J. M.

I have, &c.

CALCUTTA,

(Signed) THOS. PRINSEP, *Capt. Engr.*

SUPERINTENDENT CANALS' OFFICE :

Superintendent of Canals.

26th March, 1829.

No. 114.

No. 188.

TO CAPTAIN T. PRINSEP,

Superintendent of Canals.

SIR,

I am directed by the Canal Committee to acknowledge the receipt of your Letter under date the 26th ultimo, together with a Plan of a Bridge that accompanied it.

It appears to the Committee, that the change proposed by you in substituting double Draw Bridges, with a Pier in the centre and deepest part of the Canal, is open to many objections—First, from the consequent obstruction to the water way that would be occasioned by the construction of the Pier—Secondly, from its being exceedingly doubtful whether a Pier of the dimensions stated in your Plan would be sufficiently strong to resist the concussions that it would be liable to, from the numerous heavy wood Boats that are likely to be employed in the Canal Navigation—Thirdly, that the supervision of the Bridges would render it necessary to entertain an Establishment, by whom, very vexatious exactions may be made, or, the raising and falling of the flappers be left to ignorant and heedless Boatmen, who would think of nothing beyond effecting a passage through the Bridge.

As far as the raising of the Road levels is concerned, the Committee apprehend, abundant materials will be produced from the excavations of the Canal, and which, of course, have already been estimated for, as applicable to that purpose.

Previously to a reference on this subject to Government, which will probably become necessary, the Committee have deemed it advisable to refer these objections to your

consideration; in order to ascertain whether any means existed of obviating them altogether, or of materially lessening the inconveniences that seem to the Committee inherent in the Plan suggested. It need scarcely be observed, that the paramount object to be consulted is the safety and accommodation of the community, which would, in the apprehension of the Committee, be liable to some diminution, if indeed they were not exposed to hazard, by the substitution of Draw Bridges for those on the Suspension principle. It might be useful in your reply to advert to the comparative expense of the former and the latter, in order that in the event of a reference to Government, the whole subject might be presented for consideration in a complete form.

CANAL COMMITTEE'S OFFICE,
CALCUTTA:
The 3rd April, 1829.

I have, &c.
(Signed) J. N. JACKSON,
Secretary to the Committee.

No. 115.

No. 160.

To CAPTAIN J. N. JACKSON,

Secretary to the Canal Committee.

SIR,

I have the honour to acknowledge your Letter of 3rd instant, conveying the sentiments of the Canal Committee upon the alterations suggested in the construction of the several Bridges across the Circular Canal. Not apprehending when I forwarded the proposition, that the objections now urged against the change of construction could have had such weight in the considerations of the Committee, I then thought it unnecessary to enter more fully into the relative advantages of the two Plans. I am therefore much relieved by the indulgence of the Committee in referring this subject, on which they hesitate to concur with me in the preference of Draw Bridges, that I may state more particularly my views on the subject.

2. The first objection urged in your Letter is on the score of obstruction to the free passage of the water by the position of a Pier in the centre, or what they naturally suppose the deepest part of the Channel; the Committee have not probably adverted to the scheme submitted and sanctioned for the details and management of the Circular Canal,—the construction of the Chitpoor Gates, which are to have two openings of 24 feet each, with a Pier in the centre; and the manœuvring of the ebb and flood Gates, by which the tide will never be allowed to run with any thing beyond a very moderate velocity, sufficient only for the purpose of cleanliness.

3. In the Sketch accompanying my Letter of 26th ultimo I have delineated the section of the Canal, purposely to show how little contraction of water way will be necessary, and I believe it cannot be said by any person conversant with the subject, that a diminution of $\frac{1}{12}$ th from the average section can have much prejudicial effect in the free passage of the water, where the current will remain so slack.

4. The second objection relates to the dimensions of the Pier, which the Committee fear may be insufficient to sustain any violent concussion from the heavy laden Craft which are likely to frequent the Canal. This objection has probably arisen from what the Members of the Committee have witnessed so often in Tolly's Nulla, where these Boats are constantly allowed to drift with the full velocity of a current of two to three miles an

hour without any check or control but that of a bamboo luggee or pole. Even under these circumstances, I should consider a Pier of six feet beyond the fear of being destroyed by such concussions, unless the height were much greater than at present proposed.

5. Generally speaking, where a Navigation is carried on by tide or current without assistance from the Banks, I acknowledge there exist great objections to a divided water-way ; but even in Tolly's Nulla, where the tide has so much comparative velocity, the passage of Boats is for the most part confined to one side of the Nulla, while the other side is lined by Craft at anchor, the centre remaining unoccupied. And it must be kept in mind, that in the Circular Canal, where the current will be moderate, and the use of the track rope more frequent, this division of the stream will still more obtain.

6. The third and last objection is one of more weight, and which I had not neglected to consider. In the Sketch forwarded I had designedly left a clear height in ordinary tides of 12 feet under the Bridges, to render the lifting of the Bridge necessary only to masted Boats or the larger Craft. Perhaps an additional 3 or 4 feet making this height 15 or 16 feet instead of 12, may be advisable, and it cannot add much to the expense of masonry required.

7. By thus limiting the necessity of lifting the Bridges, to the passage of the larger Craft having stronger crews and more wealthy owners, and to masted Vessels, such as Pinnaces and Budgerows, who are not likely to submit tamely to any illegal exactions on the part of the Chokeydars in charge ; the dread entertained against any Establishment will be much lessened if not wholly obviated.

8. No person, however, can visit Tolly's Nulla and the Eastern Canal, without being impressed with the actual necessity of some surveillance to preserve the Navigation of those Canals. In the former the evils are partly obviated by the rapidity of the current, which renders it more than hazardous to subject any Boat at anchor to the concussion of another drifting freely with the tide ; but in the Eastern Canal, there is no perceptible current, and where there is actually no Government Officer of any kind with authority to interfere, but the Native who farms the Revenue or Tolls of the Canal, possessing no other power but that of enforcing his dues, and preventing the entrance into the Canal of all who resist ; the great advantage of an Establishment are more especially felt ; the passage being frequently closed for days together with much loss of property by Boats being swamped in the confusion.

9. My remarks upon a subject which is properly beyond my province as an Engineer, will, I hope, be received with indulgence, and as dictated only by my interest in the improvement of the Canals. I should hope, that it never will be contemplated to continue the collections of the Circular Canal by the same system of farming, or if so, that the Canal may not be left in the same neglected state without Police to protect its navigation. It cannot be so difficult to prevent abuse where the Establishment required is so small and checks are so easily established, and where a general and public benefit must accrue from such an Establishment properly constituted, I should apprehend that the chance of abuses, trifling as they must be, will be more than amply balanced by the advantage.

10. The Draw Bridges over the Dutch Canals alluded to in my former letter are so nicely balanced, that any foot passenger may lift them at the request of the Boatmen passing under, and require no Establishment whatever. Few other European Canals are without bridges equally simple and readily lifted, or turning Bridges : for the advantage of allowing masted vessels to pass is too much to be sacrificed. If, however, it is thought that too great simplicity in the raising of the Bridge will place it in the power of careless Boatmen to endanger the passengers on the Road and Bridge thoroughfare, it will be easy to obviate this by an alteration in the mode of lifting the Bridge, and substituting a

crank for the present lever, to remain under charge of a Khulassee, who will possess the key, or otherwise, by altering the Draw to a Turning Bridge.

11. Concerning the relative expense of the two kinds of Bridges—Suspension or Draw Bridges, as proposed. The expense in masonry will be very nearly the same, and the difference will be that of the two Bridge-ways, iron or timber; and I am of opinion, that the former of iron will exceed the expences of the proposed design on account of its greater length—20,000 Rs. has been allowed in the Original Estimates for each Bridge of Suspension, for which sum I believe a Bridge of 100 feet span could not be constructed. The Bridges according to the Design forwarded with my letter of the 26th ultimo, will amount to about this sum.

I have, &c.

CALCUTTA, CANAL OFFICER,
4th April, 1829.

(Signed) THOS. PRINSEP, *Captain,*
Superintendent of Canals.

(True Copies)

J. N. JACKSON,
Secretary Canal Committee.

No. 116.

No. 189.

To E. MOLONY, ESQ.

Officiating Secretary to Government.

Territorial Department.

SIR,

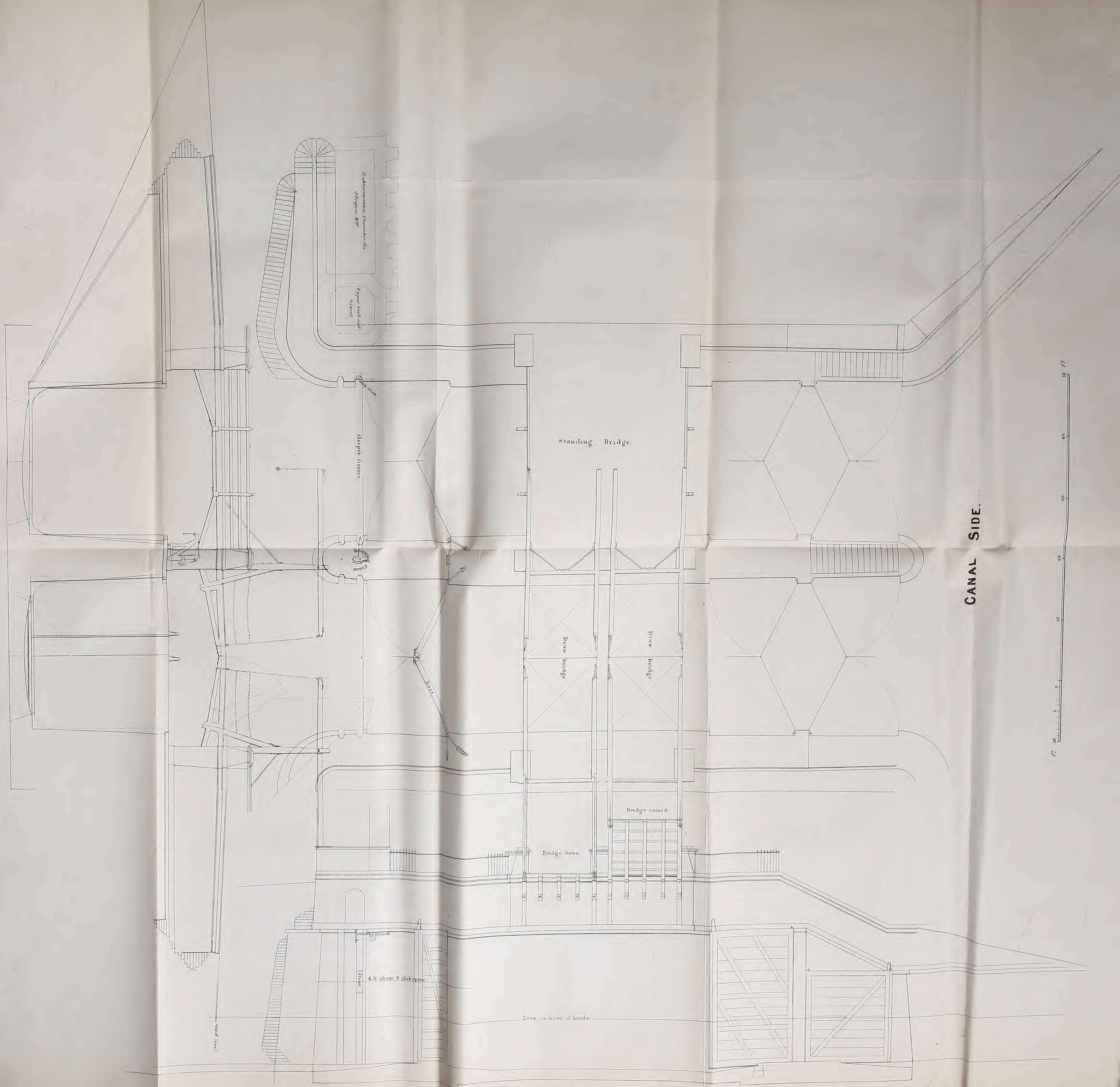
I have the honor by desire of the Canal Committee to forward herewith for submission to Government, copies of a Correspondence with Captain Prinsep, Superintendent of Canals, together with the Plan in Original that accompanied it.

The Committee cannot recommend to Government the adoption of the change proposed by Captain Prinsep.

First. As the construction of a Pier in the centre of so narrow a Navigation and in its deepest part, must obviously cause very serious obstruction to the water-way, and from its being exceedingly doubtful, whether, one of such dimensions, would be sufficiently strong to resist the concussions from the numerous heavy wood Boats that are likely to be employed upon it, and a more substantial one would increase the obstruction above adverted to.

Secondly. From the liability of the materials to speedy decay, and the consequent inconvenience that must arise from the passage of the Bridge being closed, while the necessary repairs are carrying on, and when the flappers were raised, particularly in such crowded thoroughfares as those through Chitpoor to Cossipoor, Barrackpoor, Dum-Dum, and to Balia Ghaut.

Again, the adoption of Captain Prinsep's Plan involves one of the two following consequences, viz.—The management of the Draw Bridge must devolve, either upon heedless Boatmen struggling to effect a hasty passage, or an expensive Establishment must be entertained at each of the several Bridges to look after them. From the former, very serious injuries to the Bridges must be expected, and from the latter, considerable inconvenience and vexation, as they would constantly refuse to raise the flaps until some exorbitant and unauthorized demand were complied with, and whatsoever vigilance might be exercised, it would, in numerous cases, be attended with much labour and difficulty, in prosecuting the offender to conviction.



Submersible Chamber for
Sluices &c.
Upper Lock outwards

Standing Bridge.

Draw bridge

Draw bridge

Bridge raised

Bridge down.

6 ft above 0. click opens

Zero. or base of levels.

CANAL SIDE.



Mag. North



ahmumghatta

EASTERN LAKE.

- References
- AB. A walking bund
 - aaa. Temporary bridges
 - CD. Canal excavated this year
 - DE. Line for next year
 - EF. Nullah to be widened

SKETCH

of the

RAHMUNGHATTA CANAL

as executed in

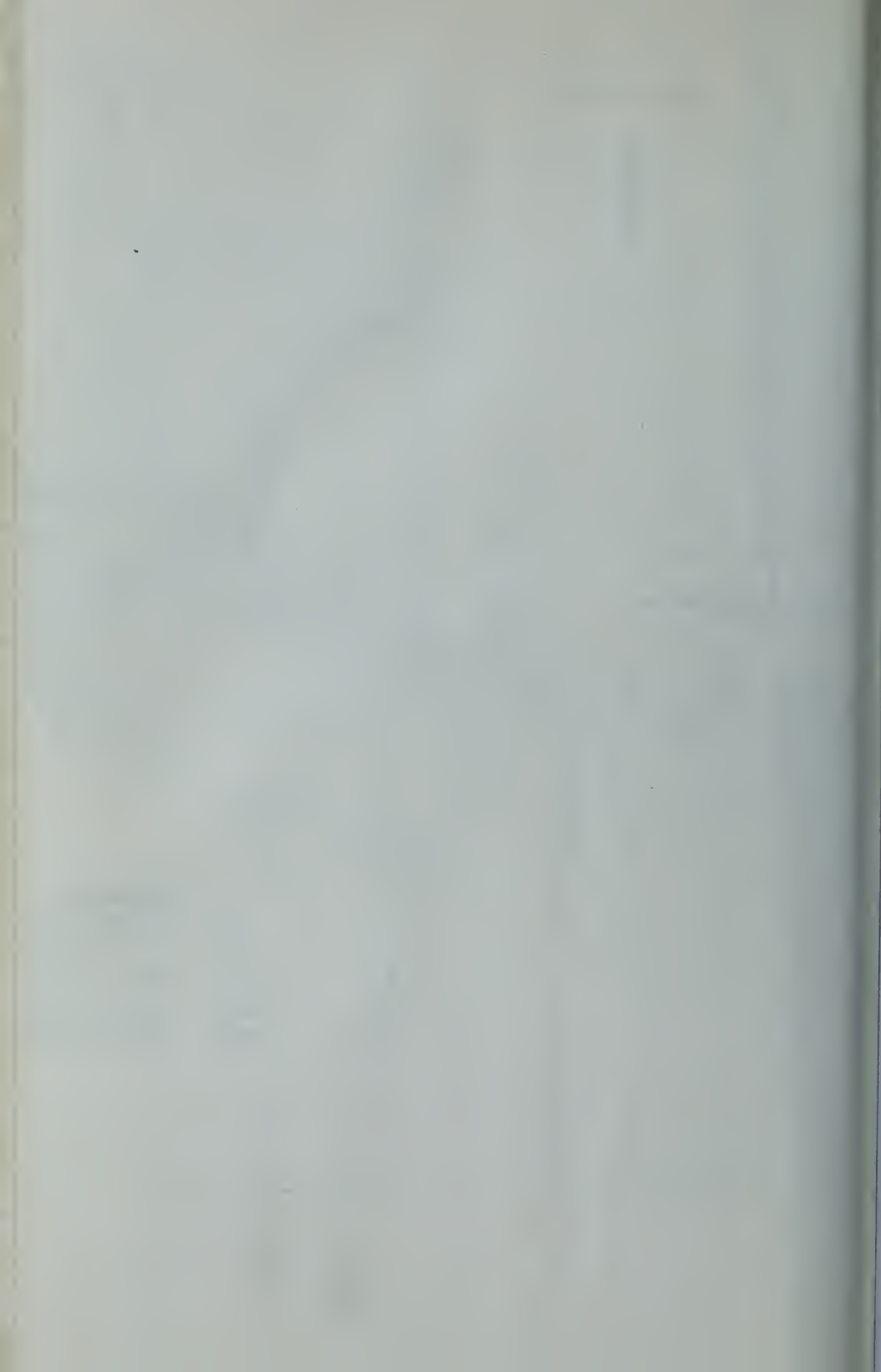
1828/29

*Sept. 1829. Sig. J. Tho. Pinnup Capt. Eng.
Supt. Canals*

hantatulla

Scale of fathoms to a mile





The durability and elegance of Bridges on the Suspension principle must be readily admitted, and the Committee apprehend the difficulty (if it can so be called) from the roads specified in Captain Prinsep's Letter, being on a level that will not admit of Craft going under the Bridges with their mast up, is readily and easily surmounted. As the excavations from the Canal will afford abundant material for the construction of the Road-ways up to the Suspension Piers to the level of the Bridge Platform, as is at present the case over Tolly's Nulla, at Gurraah Haut, and Tolly Gunj.

I request the Plan, when no longer required, may be returned to the Office.

I have the honor to be,

Sir,

CANAL COMMITTEE'S OFFICE,

CALCUTTA:

The 9th April, 1829.

Your most Obedient Servant,

J. N. JACKSON,

Secretary to the Committee.

No. 117.

No. 453.

To MAJOR J. N. JACKSON,

Secretary to the Canal Committee.

Miscellaneous—Revenue.

SIR,

I am directed to acknowledge the receipt of your Letter No. 189, dated the 9th instant, with its enclosures, and in reply to communicate as follows:—

The Governor General in Council concurs with the Committee in the preference which they give to Iron Suspension Bridges over Draw-bridges of the description proposed to be erected by Captain Prinsep on the several Roads intersecting the Circular Canal, His Lordship in Council accordingly directs that the original intention of constructing Bridges of the former description shall be adhered to.

The circumstances mentioned in the 8th and 9th paragraphs of Captain Prinsep's Letter, dated the 4th instant, having attracted the notice of Government. I am directed to state for the information of the Committee, that a report on the subject will be required from the Revenue Officer in charge of the collections of Tolls in Tolly's Nullah and the Eastern Canal.

The Plan which accompanied your Letter is herewith returned.

I am, &c.

The 14th April, 1829.

[(Signed) HOLT MACKENZIE,
Secretary to the Government.]

No. 118.

To MAJOR J. N. JACKSON,

Member and Secretary to the Canal Committee.

SIR,

I have now the honor to submit for the information of the Canal Committee, my Report of the progress made on the different works under my Superintendence during the past season 1828-29, accompanied by a Schedule and Estimate of the objects upon which it may be thought necessary to employ my attention during the approaching season. This report has been delayed to a somewhat later period than usual: first, on account of the state of the Accounts of the Department, which have unavoidably got somewhat in

arrears from the great accession of business accruing from the works of the Circular Canal ; and secondly, because the works of the Circular Canal have not been subjected to the temporary suspension usual on the other Canals during the rainy months, but still continue in progress, although not with the same vigour as in the dry months.

2. The scheme of Mofussil operations for the past season submitted in September last, and sanctioned at the recommendation of the Committee, embraced the following objects :—

1. Dredging operations, estimated @	..	..	..	..	8,400	0	0
2. Bahminghatta Canal,	..	..	..	..	25,000	0	0
3. Old Ghoonamagee Nulla,	..	..	..	..	2,500	0	0
4. Bhowaneeepore Canal,	..	..	..	..	18,000	0	0
5. Hoseinabad and Bayleygunj,	..	..	..	..	500	0	0
6. Balyaghat Road Drains,	..	..	..	..	250	0	0
Total Estimate,					54,650	0	0

3. The expenses which have been actually incurred upon these items respectively are as per separate abstracts :—

1. Dredging old machine,	..	..	..	..	3,733	4	8
Ditto new ditto,	..	..	..	..	2,945	10	11
						6,678	15 7
2. Bahminghatta Canal, Goonamagee to Kantatulla,	13,850	10	6				
Kantatulla to Bahminghatta,	..	..	..	9,520	11	3	
						23,371	5 9
3. Old Ghoonamagee Nulla,	..	..	..	..	3,520	12	9
4. Bhowaneeepore Canal,	..	..	..	..	17,120	6	8
5. Hoseinabad Canal only,	..	..	..	..	159	15	1
6. Balyaghat Road Drains,	..	..	..	..	90	7	5
Total Mofussil expenses,					50,941	15	3

4. In the above I have not included the expenses of the Circular Canal, the orders upon which were received separately, and subsequently to the instructions upon the scheme for Mofussil operations. I shall therefore proceed to remark upon these several works in the first instance, reserving the Circular Canal for a separate consideration.

5. Upon the first item in the list, viz. Dredging operations, I have to remark, that the expenses incurred have fallen within the estimate, chiefly from the last constructed machinery working with greater economy than the first constructed. The expense in wear and tear of iron buckets and links, as also in the constant repairs and caulking of the eight mud lighters, which are of native construction and material, is however still very great, amounting to an average of 20 to 25 per cent. upon the other expenses.

6. For the chief part of the season, the new machinery, the strongest and best adapted for excavating in the hard ground, was kept at work, without the limits of the Canal in the upper Lake Channel in the neighbourhood of the first Chokey. The bed of this Channel does not partake of the nature of that within the mouth of the Canal, but is of a more consistent and stiffer composition. It appears generally to be an iron-colored yellow clay, with great admixture of shelly debris, whereas the bottom within the Canal, and in most of the stagnant parts of the Lake, consists of a black mass of soft silt, slime, and rubbish. In the Lake this rubbish is formed of vegetable matter from the decayed reeds and aquatic mosses which prevail. In the Canal the rubbish is chiefly that brought from the city Drains and crowd of Boats plying along its course, which finds no exit on account of the stagnation of this Canal.

7. The hard bed in which the new machinery usually excavated, does not yield so readily to the edge of the iron buckets, and its daily quantum of work performed on this account seldom exceeded five boats *lowly* in place of the usual quantity of six.

8. There is however this difference in the work performed in this hard bed, that whereas in the soft ground within the stagnant Canal, there is a constant filling in from the soft mud of the sides, besides the continued silting and deposit of rubbish, which does not allow the whole amount of excavation to have its beneficial effect on the navigability of the Canal, every inch excavated in this harder bottom, over which a tolerably strong current runs during one-half to low ebb in the dry months, is a positive gain to the depth of the Channel.

9. The excavations of the season have had an evident effect in improving the navigation of the Canal, bringing the bed to within one foot of the level, to which the inner Canal was deepened in the year 1826-27, while the deposit in that part has nearly raised it already to a par with the part dredged.*

10. I cannot however yet recommend it to the Committee to discontinue the dredging until another season has past; indeed I believe it will be advisable to continue until some little time after the opening of the new Circular Canal has had its effect in remedying the present stagnation of tide in this Canal, when I have no doubt of being able to place it on a par with the best parts of Tolly's Nulla in point of draft [*draught*] of water for the Craft which usually frequent these passages.

11. On this part of the general scheme of Canals, I have as yet proposed nothing as a substitute for the Lake tracking paths, proposed and commenced by my predecessor, but abandoned after the first year as expensive and perhaps impracticable.† If the Committee deem it advisable to recommend the resumption of this work which my experience on the last mile of the Bhaminghatta Canal teaches me to be perfectly feasible, I am ready to submit a statement of the method and expense of constructing an embankment along the South bank of the Lake Channel, where it is chiefly required, with Bridged opening, to allow a perfect freedom of tide—which embankment will perfectly answer the purpose of a tracking path.

12. In my Scheme for the approaching season I have inserted the bare expenses of the two Dredging Machines at an Estimate of 600 Rs. per month, on the impression, that the Committee may deem it advisable to defer all subsidiary objects of the kind, as also the widening and strengthening different parts of the present Eastern Canal until the new Circular Canal is in a more forward state, and such works become more immediately necessary.

13. The Second item of the Scheme of Mofussil operations, Bahminghatta Canal is divided in my accounts and abstracts into two heads, the Canal from Ghoonamagee to Kantatulla and that from Kantatulla to Bahminghatta.

14. With respect to the first part from Ghoonamagee to Kantatulla, the inclemency of the month of June of the present year, alone prevented me from finishing it, and there will still remain a small quantity equal, including the two mouths, to about 500 Chowkas to excavate during the approaching year.

15. The excavation of this year have been entirely successful, and universally to the requisite depth of 12 to 14 feet. In no instance have I been arrested by any occurrence of oozing sand, and in one instance alone has there occurred any sliding of the banks. The last 6,000 feet of this part of the Canal which form the chief part of the excavations of the season lie through jungul, with roots to remove and embankments to keep up, besides

* Particularly in the vicinity of the principal bazar at Kood Ghat, where the sediment has been at least 18 inches.

† The reason here assigned is not correct—see Appendix H. page 16. para. 33-31, page 29, para. 18, page 58, para. 4 and 5.—J. M.

some other contingent expenses to which such works are always subject, the actual gross charge per Chowka of 729 cub. feet has therefore rather exceeded the former average upon this and the Chultabarea Canal, and brings the year's average per mile upon this work to the full amount 10,000 Rupees, exclusive of the expenses of last year in cleaning the jungul and embanking.

16. With respect to the latter division of this Canal from Kantatulla to Bahminghatta. In laying out the line and cleansing it of jungul and reed, it was found that the ground to be excavated was even more unfavorable than I had anticipated; and although merely skirting, as described in my former and present Sketch, the western Lake, a number of its shallow outlets had to be traversed, and the greatest part of the ground proved soft to a great depth, and consequently difficult to inclose by embankment, and lay dry for excavation.

17. This circumstance and the unfavorable locality of Bahminghatta for the residence of any great number of Coolies, induced me early in the season to abandon the hope of completing the whole, and I restricted myself to the portion C. D. marked in the Sketch, which I have the satisfaction to say is completed to a depth throughout of 11 or 12 feet below high water; and now open to the tides, which flow through it into, and out of the Lake with same force.

18. The expenses upon this Canal, of which only 2,800 running feet have been actually finished, have been great on account of the nature of the work. I enclose a Sketch of the ground to explain the remarks which I conceive it my duty to offer on the subject.

19. It will be seen, that in the first instance a clearance and walking bund of upwards of half a mile necessary along the Koorool Khal, with three temporary Bridges and a Ferry, in order to conduct the laborers to the ground. The clearance and enclosure had then not proceeded 800 feet before it was intersected by the first considerable Lake outlet, beyond this point the ground gradually became worse, crossing in all, five other Lake outlets, which had to be bunded on both sides up to the Central Nulla at D. where the excavations of the year ceased at a point beyond the softest part of the line.

20. To embank along this line was a work of much labor time, and difficulty. The surface being all soft mud to a depth of 3 feet, it became necessary to remove most of it to procure good stuff for an embankment, which, when formed, sunk constantly and required to be frequently raised, until by constant drying and caking a tolerably firm structure was created.

21. It may easily be imagined that the expense and delay of such kind of work, the additional measures necessary to keep the laborers from desertion and ensure success, would make the Superintendent cautious in not attempting more than he could depend upon finishing. I enclosed a length C. D. proportioned to the number of hands that the two first months led me to reckon upon, which is completed to the full depth; besides which, I have employed such Coolies as declined Chowka cutting, in finishing the South bund of enclosure for the remainder of the line, and clearing the South bank of the Nulla E. F. which, when widened, will form a part of the Canal.

22. The manner in which this Canal is laid out by closing all outlets to the south and opening those to the north, and thus making the Canal the feeder and outlet for the Lake, will secure the success of this Canal in preserving its depth.

23. The remaining portion D. E. runs through more favorable ground than that already passed, and the expense will be less on account of the numerous preparatory operations which have already been made. The expense of the whole line from Kantatulla to Bahminghatta will be little above 16,000 Rs. the distance being two miles, and the excavations $1\frac{1}{2}$, inclusive of the Nulla to be widened.

	R.	A.	P.
Chaltabarea 1826-27, rate. ..	1	12	5
Bahminghatta 1827-28, ..	1	12	4 $\frac{1}{2}$
This year,	1	14	10

24. The total estimate of Rs. 72,000 for the entire Bahminghatta Canal will therefore more than cover the actual expense which is likely to be incurred.

25. The works under the next head, Bhowaneepore Canal, with some few trifling bunds, left to clear when the waters subside next year, have been brought to a close, and the Canal opened to passengers.

26. The line pointed out in my former Sketch of the ground and inserted in the General plan of this year has been strictly followed, and I have the satisfaction to report, that across the highest parts of the two spits of sand, formerly noticed as intersecting the Canal, the excavations have been carried to 8 feet below high spring water mark.

27. This Canal, although similar to the Bayleygunj Canal in the circumstance of uniting two tideways, offers even more chance of success over that Canal than I had formerly stated. It appears by my observations when the Canal was opened in May, June, that there is a difference of nearly one hour between the first ebb in the two Khals at the two ends, which is likely to induce a set from the Gobra to the Hinshee Khal during ebb tide, which, with the help of the back water in the Bhowaneepore Jheel when opened and the old Nullah at F. will effectually prevent any considerable stagnation and consequent sediment.

28. The works upon the two Canals of Hoseinabad and Bayleygunj have been limited to the deepening of the mouth of the former, opened late in the season preceding, and the expenses under this head have therefore been proportionally trifling, amounting to Rs. 159:15:1.

29. Upon the Bayleygunj Canal I have thought it advisable to incur no expense during the year, partly lest it should interfere with the progress of the Bhowaneepore Canal and chiefly because I cannot now see much improvement that can be expected from such trifling outlay upon this Canal.

30. The defects of this Canal are, I believe already fully known by the Committee. The sandy ridge in the centre, where unfortunately the tides meet, has filled by silting to 3 and $3\frac{1}{2}$ below high water mark, although excavated to 6 and 7. The chief part of this Canal, and particularly the Southern division, was left incomplete and irregular, in some places excavated not more than 3 feet. In 1826-27 I expended with the sanction of the Committee a sum of Rs. 2,052:14:9 in finishing these uneven parts to an even bottom, 5 feet below high water mark, and hoped that much would be gained when the Kullooar Bund should create an uniformity in the set of tide.

31. I have already stated that the observed tide in the Gobra and Kullooar Khals has an extreme rise and fall of 11 feet, and as there is no possibility of shutting out one tide, there remains no method of making this Canal an useful tide-passage, but by again shutting up the two ends and excavating it to low water mark or near that level. The defect of silting will still remain to this Canal, as I cannot devise any means within reasonable limits of expense to provide a head of water in the centre. Still if the two ends are sufficient in depth to allow boats to pass at half tide, and the silting is confined to the centre, any constant expense to preserve a passage that may hereafter be thought necessary will be greatly diminished, besides the improvement to the Canal as it exists at present, which must take place by such measure.

32. Whether therefore under these circumstances the Committee will see any advantage in recommending any thing to be done for the improvement of the Bayleygunj Canal, which at present forms the chief bar to the utility of the new series of cuts between Hoseinabad on the Eeshamuttee and the Salt Lakes during the approaching season, or otherwise defer it to some future period, I conceive it my duty to state what I suppose will be the result of such measure, and what the expense necessary for the purpose.

33. In its present state, the Canal is only available at high water (or for 2 hours of each tide of 12 hours) for Boats drawing 3 to $3\frac{1}{2}$ feet water. When excavated to low water mark, (and perhaps 8 feet below high water in the centre beyond which is oozing sand) the passage will be available to Boats of 7 feet draft as a tide-passage, the silting will not be so rapid and general in the Canal, although far from being altogether obviated. The expense of the excavation of an additional 5 feet average will amount to 8 or 9,000 Rupees at the least.

34. Upon the last head of the above Scheme, Balyaghat Road Drains, I have incurred only the trifling expense of Rs. 90 : 7 : 5 upon five Cross Drains.

35. I trust that the Committee will not, on mature consideration, think fit to report otherwise than favorably of the general progress of the works above enumerated in their communications with the Governor General in Council.

36. The expenses have been at what must be looked upon as a moderate rate, considering all things. The balances left outstanding upon these works, all of which proceed upon contracts with advances, and could not be managed otherwise with economy, have decreased in proportion to the amount of outlay each succeeding year of my Superintendence, and although much delay and some litigation occurs in recovering these sums, I hope to be able in the end to recover the whole.

37. The ill success attending the suit against the defaulters of 1823-24 has, I cannot hesitate to say, created a feeling among the contractors usually employed on such works, which has originated most of that reluctance to settle their accounts without legal proceedings, which I have experienced, and this belief of their impunity, which has prevailed, is likely, I fear, as long as it lasts, ever to stand in my way in the Mofussil works. I am happy however to state, that whatever legal measures have been resorted to at different times for the recovery of balances, have been with very few exceptions, successful. I attach to this report a statement of the balances incurred and their present state, from the year 1826.27 to the present moment.

38. I shall now proceed to remark upon the several objects, which should occupy my establishment during the approaching season.

39. To assist in the general view, I have forwarded an outline Map of the whole line between the Eeshamuttee River and Hooghly River at Calcutta, on the scale of 2 inches to one mile.

40. The only point of the projected Cuts along the whole extent, whereas yet no commencement has been made, is that Cut of $1\frac{1}{2}$ mile formerly denoted by the letters X. Y. of my former Sketches, between the Hinshee and Bairmaree Khals. This Cut X. Y. formed a part of the series of Cuts proposed by Major Schalch in 1823-24. Upon a survey of my own, to replace the original straight line of 10 miles from Hosseinabad to Bassera, which was sanctioned upon the plans originally submitted by Major S., and as I deferred its execution, I have not hitherto proposed any deviation from it.

41. The whole of the line X. Y. is remote from the cultivated Country ; and my experience of the difficulty, expense, and uncertainty of work so situated, leads me at once to prefer another route which I have marked on the accompanying general outline plan. I have the honor to recommend it to the consideration of the Committee. The distance by the two routes varies scarce half a mile. The Khal which is followed although somewhat tortuous, is sufficient in depth and section, and the line of excavation necessary is reduced from $1\frac{1}{2}$ to less than 1 mile, besides being through the cleared of Chaitil. The line X. Y. could not certainly be excavated at a less expense than Rs. 25,000,—while the new proposed route may be opened at 10,000.

42. I have inserted this proposed Cut in the Schedule for the approaching season. Should however the Committee still wish to defer it on the ground that a route still exists by the Akkratulla and Bairmaree Khals, to connect the Bhowaneepore Canal with Bassera, the item may be struck from the Estimate.

43. The several points where the works remain unfinished are Bahminghatta and Bayleygunj, upon both which I have already submitted my remarks.

44. Besides the several Canals above alluded to in the series, it was, I believe, contemplated to form a clearance and tracking-path along the banks of the several natural passages which were to be taken into the route.

45. Upon this point I have as yet submitted no specific proposition to the Committee, nor have I proposed any measures for clearing away the various trees and sunken roots which obstruct parts of the passage, more especially in the Hinshee, Gobra, and Dairsai Khals. I have ever considered these points as secondary, and such as might proceed even after the trade is attracted into the new route. I am ready however, whenever the Committee think it advisable, to commence these several objects.

46. My Schedule for the approaching season is therefore as follows :

1. Dredging operations at 600 per month,	7,200	0	0
2. Bahminghatta—			
Jheel Canal, 2,300 feet, and 1,760 feet of Nullah to widen, ...	7,000	0	0
Ditto 500 Chowkas to complete, and opening of two ends E. of			
Kantatulla,	1,000	0	0
3. Chaitil Canal, one mile, if approved,	10,000	0	0
4. Deepening Bayleygunj Canal, average 5 feet, if approved, ..	8,000	0	0
<hr/>			
Total Estimate,	33,200	0	0

47. In the above Scheme I have still limited myself to the parts of the Scheme of Canals West of the Eeshamuttee. It has hitherto been thought expedient to wait the result of the opening of this series of Cuts to the West of the River named before the works farther Eastward are attempted ; among the several Canals proposed beyond this River there are some of inconsiderable length, which, from their position, cannot be of doubtful result. Such for instance as the isolated Canals proposed at Bytaghatta, Bungurreea, and Narroolee, while the more extensive one at Sreepoor remains still for farther investigation.

48. The three Canals of Bytaghatta, Bungurreea, and Narroolee may, if judged proper by the Governor General in Council, at the recommendation of the Committee, be undertaken immediately, and with advantage to the general navigation of the Soonderbuns. I shall however, I fear, experience some little inconvenience without a covenanted assistant, in superintending Works at such a distance as 3 to 4 days' journey, while the Circular Canal Works, and the Flood Gates and Bridges, require such constant attention.

49. I shall now proceed to report upon the progress made upon the New Circular Canal up to the present moment, with some observations upon the expected period of its final completion, and the proceedings of the approaching season.

50. The instructions of the Committee allowing me to commence upon the New Circular Canal were received only late in January last, and my proceeding upon this work therefore can only date from February. The season however has proved remarkably favorable, and I have completed more of the excavations than I had at first anticipated.

51. The whole length of this Canal, including Basin and opening towards the River, will be between 19,000 and 20,000 running feet. Up to the first August the excavations had been finished and brought to account upon 105 lots, containing $23,739\frac{3}{4}$ Chowkas, of 729 Cubic feet, and comprising a length of 10,526 running feet, besides that a considerable progress had been made upon 7 or 8 other lots, 100 feet each ; these excavations extend as exhi-

* Division G No.
23. Committee's
Plan.

bited in the general outline plan hereby forwarded, from the letter G. in Sealdah to the Dum-Dum Road at C., with interruptions at two points E. and F., where two Bridges of Suspension are constructing, and again at D. where the property of Kour Hurrinauth,* not yet purchased by the Committee, interfered with the line.

52. Since the 1st August, 32 lots have been opened and nearly finished to a depth of 6 feet between Sealdah and the Eastern Canal; also 24 lots between the Dum-Dum Road and the site of the proposed Flood Gates at Chitpore have been commenced, and some progress made as far as the arrangements for the ground have allowed.

53. The estimated number of Chowkas for the whole Canal amount to somewhat less than 50,000 Chowkas, so that I may safely say, that I have already completed upwards of one-half of the excavations, inasmuch as up to the present moment the number of Chowkas brought to account is 24,603, while those excavated and yet unmeasured cannot fall far short of 3,000.

54. Besides the above work, the foundations of two Bridges, viz. the Manicktulla Road at E. and Ramlochun's Road at F., have been carried to a height of 3 feet above the tracking-path, as shown in the design formerly forwarded to the Committee, and a sufficiency of bricks made at the intersection of the Sambazar and Dum-Dum Roads for a third Bridge.

55. With respect to the method pursued in conducting the work, I have, as hitherto, preferred contracts for small portions of 100 feet each in length, with this difference however in the mode of proceeding, that instead of giving advances generally equal to one-fourth or one-third the expected cost of the work, I have succeeded in avoiding any advances in the first instance, paying to the contractors from time to time small sums to allow them to retain and feed their Coolies, proportioned only to the work already executed at the time of each payment.

56. The inconvenience of outstanding balances is thus entirely obviated, and hitherto I am happy to say, that every settlement of accounts with the contractors employed has exhibited a balance in their favor; nor has this change of system in any way fettered the progress of the work, and I have only to regret that local circumstances prevent my instituting the same arrangement with the Mofussil operations.

57. The whole of the works in the two Divisions, D. E. and E. F., were filled with water during the night of the 27th June last, when the unusual quantity of rain† which fell during that and the preceding days had the effect of flooding the Roads and Villages adjoining. The inundation in breaking over the Roads into the Bridge excavations destroyed the side Drains which had been provided to carry off the rain water from the Town, from thence as well as over the Road it entered the Canal excavations, which were filled in the course of a few hours up to a level with the side Roads.

58. The excavations in the Division E. F. were at the time entirely completed, and there remained only one lot in the Division D. E. unfinished, the excavation of which may be easily resumed when the waters have been drained down to the level of the Eastern Canal during October and November next, so that no material inconvenience is likely to arise from this inundation.

59. The work on the two Bridge foundations suffered more material inconvenience, and some additional expense was incurred.

60. In July new side Drains were provided, the Roads repaired, the connection of the Bridge excavations with the Canal cut off, and water pumped from the foundation. The work was again resumed before August without further inconvenience, and is now only somewhat delayed by the state of the Roads, which are unfavorable for the speedy transport of materials.

† The rain which fell on the 27th June is quoted in the Register published by the Survey-General at $6\frac{2}{10}$ in.

61. In my design and observations relative to this Canal, submitted in October 1827, I stated my expectation, founded on the different wells which I had sunk for the purpose of ascertaining the nature of the soil, that the depth proposed for the excavation upon my improved plan would scarcely touch upon the stratum of oozing sand at any part.

62. My hopes have so far been realized that in two cases only has any inconvenience at all been experienced from either this sand or from springs of water, in neither case of any consequence.

63. At the Bridge at F. at the intersection of Ramlochun's Roads, the foundations have been carried about 3 feet into the sand, and in the adjoining five lots, the excavations have been carried a foot into the stratum of sand. These numbers, being the first excavated, some delay was occasioned by the great accumulation of water. The finishing of the remaining numbers, between these and the Bridge at E., in which no sand was reached, allowed me the means of Draining off this water, and indeed laying the stratum of sand so far dry as to allow of the Bridge excavations being carried without difficulty to the requisite depth of $2\frac{1}{2}$ feet below the bottom of the Canal.

64. The Manicktulla Bridge foundations do not touch upon the stratum of sand which I believe to be 2 or 3 feet below the masonry. In the adjoining numbers towards the North, however, great inconvenience was experienced from the quantity of water which came into the last three feet of the excavations—a large body of water in a tank adjoining may have been one chief cause of this, as generally no sand came out of the excavation.

65. The gross charge per Chowka of 729 feet, inclusive of all expenses of establishment and contingencies, and some that were not anticipated in the estimate, such as grassing the slopes, levelling the side Roads, and piling many parts where soft bed of old tanks or new mud threatened to slide into the bed of the Canal, has been up to the 1st August Rs. 2 : 3 : 0, which may be considered a very moderate average, where the third Chowka or beyond 18 feet has been reached. The contract rates for the different depths of 9 to 18 feet and 18 to 27 feet have been much as usual—being for the first Chowka Rs. 1 : 6 : 0 to the depth of 9 feet : 2/0 for the second to the depth 18 feet, and 2/12 for the third to the depth of 27 feet.

66. It now remains for me to offer my remarks upon the work remaining for the approaching season, which will, I hope, very nearly complete the excavations, leaving only the mouth to open during the following year, with perhaps some works connected with the system of Flood-Gates and the different Bridges and Roads.

67. The three remaining Bridges will be commenced early in the season ; I have already proposed to the Committee, on account of the extensive thoroughfares, to construct two of these Bridges, viz. those on the Barrackpore and Dum-Dum Road, on a different Plan, with a double Road-way. I have now the pleasure to forward an outline design for the masonry which is only increased in solid content, by the alteration, to the amount of 8,000 cubic feet. Captain Baker will be ready to state the difference of expense in iron-work and road-way.

68. It is also my intention to commence at an early period upon the foundations of the system of Tide-Gates near the Chitpore Bridge.

69. In the Plan now before the Committee under the sanction of Government, I had assigned a position to these Gates purposely a little removed from the line of the present Road, in order that the progress of the work might not interfere with the existing thoroughfare which is very extensive—as also to give the approaches to the Bridges across the Tide-Gates a more direct course than the present Road could afford, which is very oblique. I have the pleasure to forward a Sketch surveyed by H. Turner at my request, exhibiting the different properties which will be required for a Road of approach to the works when

See Nos. 54, and
55, of Appendix to
Appendix (H).—
J. M.

placed in the most convenient site. I have made the line interfere as little as possible with valuable buildings, and I have to recommend it for adoption in preference to any interference with the present Road until the work is complete.

*† These designs or Plans in original, are lodged in the Office of the Military Board.—J. M.

70. In the design* for the Tide-Gate already with the Committee, there are to each opening two gates only—one pointing land-wards the other River-wards. As however it appeared, from several opinions which were procured by the Committee from professional persons, that a third Gate to each opening was generally considered as offering more security and advantage than would compensate for the additional expense, I have thought it incumbent upon me to prepare a Plan† with such addition, according to which Plan I am also preparing a working model upon a scale of half an inch to a foot.

71. The additional expense in solid masonry alone will be about 5,000 Rs., on account of the extension of the pier and abutments to allow of a chamber for Boats of 50 feet clear. Hatches will be necessary to both the large Gates pointing towards the River, with crabs or gear to work the Gates. So that the additional expense above the former estimate of 60,000 Rupees will not much exceed 10,000 Rupees.

72. I have no hesitation to say that the additional pair of Gates will afford greater security against any failure or irruption of the River into the Canal in its highest state.

73. The Flood-Gates, or those pointing towards the River, will probably not be used at all between the 1st November and 1st of March, or last Springs of February. They will be used only during the Spring Tides of October, March, April and May, and I conceive that the double Flood-Gates, as a lock, will be used only on occasions of emergency during the remaining four months, June, July, August, and September.

74. In the design now forwarded, I have also inserted a Draw-Bridge of double flaps, in place of the standing wooden Bridges of the former design—the objections which induced the Governor General in Council to disapprove of the application of this kind of Bridge to the other parts of the Canal, cannot of course bear with the same force upon the present case: a Bridge on the Suspension principle would manifestly be totally out of character with the rest of the present structure, besides that its cost would be greater, and the choice appears to rest entirely between a fixed Bridge of timber or iron—a revolving Bridge, such as are used over Canals and Docks in England, of iron or timber, and a Draw-Bridge on some similar construction to that exhibited in the accompanying Plan.

75. Upon the several subjects on which I have now brought forward specific propositions relating to the Circular Canal, I have to request an early consideration; as I am prepared to proceed upon the works without further loss of time; having made all arrangements, and already received from Benares the Chunar Stones necessary for the Gate sills.

76. I have further to remark, that I believe the Committee are already aware how straitened for room to receive the earth of excavation, I shall probably find myself between the Barrackpore Road and Chitpore, in which part of the work the width has to be extended for forming the basin and the ground itself is naturally high. I have staked out the Canal at the width of 180 feet,‡ which with 30 feet of Road on each side, will allow from the quantity purchased only 80 feet on each bank to contain the earth.

‡ My design stated 200.

77. The subject has already been brought before the Committee in my application for certain Tanks that lie adjacent, all which it is highly necessary should be rendered available. It would also be highly beneficial if any arrangement could be made with the neighbouring proprietors for lease on emergency to fling some of the earth on their grounds.

78. I have also to request the permission of the Committee to fill up the old Mahratta Ditch, which will provide for a considerable quantity of the earth—I conclude there can be no objection to this measure, for its present use is chiefly as a boundary, which will be just as well provided by a mound formed from the earth of excavations as by a drain.

See Nos. 663, 663 a, 665, 667, and 667 a, of Appendix to Appendix (H).—J. M.

79. In adverting to the mound formed from the earth of excavation, it will not perhaps be thought irrelevant in me to suggest a method for future consideration of gradually removing or at least diminishing its bulk. Its presence is certainly both unsightly and inconvenient, and may, in all probability, interfere greatly with the advantageous resale of the ground upon which some reimbursement is expected for the outlay upon the work.

80. I shall require during the approaching year for the works of the Canal alone, a quantity of bricks equal to 30 lacks, all which it is my intention to derive entirely from this earth. It occurs to me that the position of the Canal will be in every way convenient for a brick manufactory for Government, and even general purposes of the market, and that in this manner, with proper direction, convenient sites may be cleared for bazars and wharfs in the first instance—and in time further clearances be made along the whole ground until it is reduced to a state in which its sale would not be prejudiced by the position of the earth of excavation.

81. The suggestion is not perhaps unworthy of serious consideration, and I shall be happy, if by my own exertions, I can in any way conduce to so desirable an object, by either myself superintending any measure of the kind, or undertaking it on the part of Government as a brick manufacture for the first year, instead of the usual method of dealing with Native contractors, who always deliver inferior bricks.

82. I have not during the season drawn to the full amount of the assignment granted upon account of the Circular Canal, as will be seen in my accounts. The whole expences of the Canal have been sanctioned at an estimate of about 3 lacks, inclusive of Iron Bridges. For the expenses of the approaching season, in addition to the balance still lying in the Treasury, it will, I expect, be sufficient if another assignment to the same amount of one lack be placed at the disposal of the Committee. If, however, I should find in the progress of the works that farther funds are necessary, it will be always in my power to make timely application.

83. Having now submitted my remarks upon the different works of the season, I have to hope they will prove satisfactory. The Committee are, I believe, aware of the superior importance which I have ever attached to the Circular Canal among the various other objects of the General Scheme, for improving the navigation of the Sunderbuns which is in progress, and my consequent anxiety to complete it at the earliest period. I should not however wish it to be supposed, that it is in any way my desire to do this at any sacrifice to other objects, and if the Committee are of opinion, that the Schedule herein submitted for Mofussil operations is too inconsiderable, which, reference to the final completion of the whole series of works, and to the scale of the Government Canal Establishment, I shall be most ready to extend it, which may be done without difficulty, by the help of some covenanted or uncovenanted assistant to reside either in Calcutta or to be deputed on the Mofussil Canals.

84. I have hitherto, as the Committee know, had no European assistance beyond that occasionally of a mechanic to assist in constructing machinery and other works of like nature. The services of this class of people are, in general, worse than useless in this country, in most objects beyond those connected with their own particular trade—and it is difficult to find one who will, from his general character and sobriety, give satisfaction even on these particular duties. The European now in my establishment has gradually declined into habits that make his services little adequate to the salary received, and as some person of the same trade will be almost indispensable during the approaching year, I shall, if the Committee see no objection, endeavour to supply his place, by taking such men as offer in the first instance only on trial. In the meantime, I have already given Mr. Charles Aiston warning of his discharge.

85. As therefore I cannot depend upon the European employed on my Establishment upon those particular objects, such as the construction of the Gates and Bridges, and every thing connected more immediately with the work-shop, for any thing like a general and useful Overseer—in case it is judged proper to extend the Plan of operations beyond the Eeshamuttee. I shall be obliged to search for an Assistant from a different class of persons more competent to act on detached duties.

86. This will however depend entirely upon the decision of the Governor General in Council upon the scale of operations for the season.

CALCUTTA, (Signed) THOS. PRINSEP, *Capt. Engineers,*
 SUPERINTENDENT OF CANAL'S OFFICE: *Superintendent of Canals.*
The 19th September, 1829.

(True Copy.)

J. N. JACKSON,
Member, performing the duty of Secretary, Canal Committee.

No. 119.

No. 96.

TO CAPTAIN THOS. PRINSEP,
Superintendent of Canals.

SIR,

With reference to the 74th Paragraph of your Letter of the last season 1828-29, dated the 19th ultimo, relative to Bridges, I am directed by the Canal Committee to request you will furnish me with the least possible delay, separate minutely particular Estimates of the three descriptions of Bridges adverted to in their document above referred, to enable the Committee to judge of the comparative cost of each.

I have, &c.

CANAL COMMITTEE'S OFFICE, (Signed) J. N. JACKSON,
 CALCUTTA: *Member, performing the duty of Secretary.*
The 14th October, 1829.

No. 120.

No. 197.

TO MAJOR J. N. JACKSON,
Member of and Officiating Secretary to the Canal Committee.

SIR,

In reply to your Letter of yesterday's date, I have the honor to state, that it is not in my power to furnish immediately, as required in your Letter, separate minutely particular Estimates of all the three descriptions of Bridges alluded to in the Report. But of the two descriptions of Bridges, of which Plans* are already before the Committee, viz. standing Bridges of timber over both openings, or a standing Bridge over one opening, and a Draw-bridge over the second opening, I have already forwarded a particular Estimate of

* The original Plans here referred to are lodged in the Office of the Military Board.—J. M.

the first, included in the general Estimate for the Tide-gates, amounting to Sa. Rs. 3,383, and its proportion of Contingencies say 338 Rs. in all 3,721.

For Standing-Bridge over one opening as per former Estimate, 1,860 8 0

Two, Draw Flaps.

Each of five trusses with standing piece included, containing 49			
running feet of Timber @ /12 per foot,	36	12	0
Heavy cramps with screw bolts about one maund,	16	0	0
<hr/>			
For the five @	52	12	0
Planking with rafters for 180 square feet @ /12 per foot,	135	0	0
Two uprights of Timber strutted,	60	0	0
Two levers with cross timber,	50	0	0
Iron tie to do., weighing $1\frac{1}{2}$ maund,	30	0	0
<hr/>			
		80	0 0
Iron work to each flap in suspending and rail chains, hinges, or			
pullies to flaps and lever bolts, &c. estimated to weigh 30			
maunds, inclusive @ 20 Rs. per maund,			
		600	0 0
<hr/>			
Per each flap,	1,138	12	0
<hr/>			
For entire Bridge,	4,138	0	0

This charge is exclusive of masonry which has been provided for in the Estimate for the whole structure, and will not undergo any material alteration by the change in the form of the Bridge.

With regard to the other Bridges alluded to, viz. Standing-Bridges of iron or revolving Bridges of iron or timber, it will require some little time to prepare drawings and consult with the persons connected with the home iron founders before any exact or even approximate Estimate of their cost can be furnished.

The revolving-Bridge if prepared will require a considerable alteration in the masonry from the space it will require in which to work, and it is evidently the construction of all others most costly, although generally preferred at home as more perfect in general advantages. I cannot suppose that a Bridge of this description of cast iron could be imported and erected at less cost than 10,000, and may cost much more.

If the Committee should see any reason to recommend this latter construction in preference, I will at a future period forward descriptions and Estimates of such Bridges in timber, and cast or wrought iron, with the corresponding alterations which will be necessary in the masonry of the pier and abutments.

I have, &c.

CALCUTTA, (Signed) THOS. PRINSEP, *Capt. Engineers,*
 SUPERINTENDENT CANAL'S OFFICE: *Superintendent of Canals*
 15th October, 1829.

No. 121.

No. 99.

To CAPTAIN T. PRINSEP,

Superintendent of Canals.

SIR,

Adverting to the suggestion by you in the 11th Paragraph of your Report, as to the construction of Tracking-paths on the Bank of the Channel of the Salt Water Lake, the Canal Committee request you will have the goodness to favor them at your earliest convenience, with the statement* of the method and expenses of constructing the Embankment, as proposed by you.

I have, &c.

CANAL COMMITTEE'S OFFICE,
CALCUTTA:
16th October, 1829.

(Signed) J. N. JACKSON,
Member, performing the duty of Secretary.

(No. 122. omitted.)

No. 123.

No. 111.

To E. MOLONY, ESQ

Deputy Secretary to Government.

Territorial Department.

SIR,

I am directed by the Canal Committee to forward herewith for submission to Government, the Copy of Captain Prinsep's Annual Report of his Proceedings as Superintendent of Canals during the past season, with the whole of the Plans in Original that accompanied it.

2. The Committee are persuaded that Government will not fail to peruse with satisfaction this very able Statement, but they are particularly desirous to call the attention of His Lordship in Council to the satisfactory results of the operations of the past season, and to the circumstance that Captain Prinsep's expences during the year have not exceeded the authorized Estimates.

3. The Committee do not consider it necessary to occupy the attention of Government by following Captain Prinsep's Report, paragraph by paragraph, but will confine themselves to the notice of such particulars as appear most prominently to require remark.

4. With regard to the system of Dredging adverted to by Captain Prinsep in the 10th Paragraph of his Report, the Committee do not at present see any objection to its adoption for the period specified, indeed it may ultimately prove desirable to continue it beyond that time.

5. The Scheme alluded to by Captain Prinsep in the 11th Paragraph of his Report as a substitute for the Lake Tracking-paths through the Channel of the Salt Water Lake, appears to the Committee deserving of further enquiry; they have accordingly called† upon

*† No answer appears to have been given by Capt. Prinsep to the application of the Committee here referred to, but about this period Capt. Prinsep met his death by a fall from his horse. The Records of the Canal Committee have been traced up to April 1830.—J. M.

Captain Prinsep to furnish them with a Statement of the probable expense of the undertaking, and of his contemplated mode of procedure for the purpose of securing its effectual accomplishment, and which shall hereafter be forwarded for the consideration of Government.

6th. In regard to the operations suggested by Captain Prinsep to be carried into effect during the ensuing season in the Mofussil, the Committee are decidedly of opinion that, it will be highly expedient to confine them to the completion of the Channels now in progress, with the exception of the Bayley Gunj and Kulloar Khal passages, and to the excavation of the new cut proposed by Captain Prinsep through the cleared country of Chitil of the former line X. Y., by which a saving of 10,000 Rupees is likely to be effected.

7th The Schedule of Mofussil Expenses will therefore stand as follows:—

1st. Dredging operations at 600 Rs. per month,	...	...	7,200	0	0
2nd. Bahminghatta.—Jheel Canal 2,300 feet, and 1,760 feet					
Nullah to widen,	...	...	7,000	0	0
Ditto 500 Chowkas to complete, and opening of two ends E.					
of Kantatulla,	...	...	1,000	0	0
3rd. Chitil Canal 1 Mile,	...	...	10,000	0	0
Total Sa. Rs.,			25,200	0	0

8th. The measures pursued by Captain Prinsep for the realization of Outstanding Balances, are regarded by the Committee as judicious, and the amount* recovered affords a most satisfactory proof that Captain Prinsep's measures were prudently adopted.

9th. The early completion of the new Circular Canal is, in the judgment of the Committee, in every point of view, peculiarly desirable, and they are of opinion, that Captain Prinsep has effected as much as it was possible for him to accomplish under the difficulties which have arisen to retard the Committee's operations in effecting the purchases of the lands required throughout the whole line.

10th. With reference to the operations proposed by Captain Prinsep in the 68th and 69th Paragraphs, the Committee remark, that they involve a considerable departure from the Original plan, and must materially increase the expence beyond the Estimates, although therefore they admit that the site now proposed for the Bridges is an improvement, and they observe that part of the expence might be covered by the Sale of the Land forming the present Road; they are not exactly prepared to recommend the adoption of the alteration. They conceive it belongs more particularly to Government to determine whether it is advisable to expend the sum required for the improvement contemplated in the appearance and convenience of the work. Should the alteration be disapproved, they are of opinion, that it will not be difficult to devise some method of preventing the apprehended interruption of the thoroughfare.

11th. The design of Flood-Gates adverted to by Captain Prinsep, in the 70th, 71st, 72nd and 73rd Paragraphs of his Report, having already been submitted to the investigation of the most competent and scientific judges and approved of by them, the Committee are of opinion, it should be adopted.

12th. The Plan of a Draw-Bridge to be erected across the Tide-Gates, suggested by Captain Prinsep in his 74th Paragraph, is similar to that formerly submitted to the consideration of Government, and although His Lordship in Council was pleased to disapprove of the general adoption of Bridges constructed on the principle, yet as it would appear from a reference made to Captain Prinsep that its cost will be only 3,721 Rupees, and as it is obvious that a Bridge on the Suspension principle would be out of character in such a

* Sa. Rs. 4,179:14:1

situation, the Committee upon the whole feel disposed to recommend the adoption of a Draw-Bridge in this particular instance.

13th. The Committee feel it their duty to bring to the special notice of Government the proposition submitted by Captain Prinsep in the 78th Paragraph of his Report, relative to the filling* up of the present Mahratta Ditch. This Ditch forms the legal and acknowledged boundary of the Jurisdiction of the Supreme Court, and although it may not appear of any material importance whether the boundary should be marked by a Ditch or an embankment, yet the Committee feel unwilling to disturb a line of demarcation so long established and recognised, without previously obtaining the express sanction of Government to such a measure.

14th. In Paragraph 80th and 81st Captain Prinsep suggests the establishment of a Brick manufacture in the vicinity of the line of the Canal. The Committee perceive no objection to the limited and immediate supply required by Captain Prinsep being prepared in the manner proposed from the earth already excavated, but they are of opinion, that any permanent Establishment of this nature would be looked upon as inconvenient and dangerous by the surrounding neighbourhood, and it might eventually interfere with the advantageous sale of surplus ground which the Committee anxiously hope to effect at a future period.

15th. The Committee have no hesitation in recommending a further assignment being made to the extent of one Lac (1,00,000) of Rupees for carrying on the operations connected with the Circular Canal, which can be increased as the progress of the work may render absolutely necessary, and timely notice of the same can be afforded to Government.

16th. The concluding Paragraphs of Captain Prinsep's Report require no particular notice, as the Committee have already suggested for the consideration of the Right Honourable the Governor General in Council the expediency of confining Captain Prinsep's operations during the approaching season chiefly to the works carrying on in the new Circular Canal, they however, could wish to be empowered by Government to authorize Captain Prinsep to entertain from time to time such mechanics as he can procure on reasonable rates of salary.

17th. The Committee request the Original plans forwarded herewith may be returned to them when no longer required.

CANAL COMMITTEE'S OFFICE,
CALCUTTA:
The 31st October, 1829.

I have the honor to be,
Sir,
Your most obedient Servant,
J. N. JACKSON,
Member, performing the duty of Secretary.

No. 124.

No. 1318.

TO THE SECRETARY TO THE CANAL COMMITTEE.

Miscellaneous Revenue.

SIR,

I am directed by the Governor General in Council to acknowledge the receipt of your Letter dated the 31st ultimo, submitting Captain Prinsep's Annual Report of his proceedings as Superintendent of Canals during the past season, and in reply to communicate as follows :—

* See further correspondence upon this subject in Appendix to Appendix (H) No. 54 and No. 55.—J. M.

2. The result of the operations carried on by Captain Prinsep during the past season, as particularly detailed in his Report, is considered by Government to be very satisfactory, and to do credit to the zeal and management of Captain Prinsep.

3. The details of the plan of operations proposed for the current season being approved generally. The Governor General in Council deems it sufficient to convey to you the orders of Government on those points only which appear to require particular notice.

4. His Lordship in Council is of opinion, that during the ensuing season the labours of Captain Prinsep should be confined to the works West of the Issamuttee,—and the Circular Canal being by far the most important of those works, his attention should be more particularly directed to its completion.

5. The Governor General in Council approves of the several works, specified in the 7th Paragraph of your Letter, being undertaken at the Estimated expense therein specified, and although the Committee have not included in the Estimate and in their recommendation the measures proposed by Captain Prinsep to be adopted for deepening, at an Expence of 8,000 Rs., the centre of the Bayley Gunj Canal. His Lordship in Council considers it to be very expedient that the excavation should be made as early as possible.

6. Treasury Orders will accordingly be issued in favour of the Committee to the extent of Rs. 33,200 for the works above adverted to, and of one Lac of Rupees for the Circular Canal.

7. The alterations proposed by Captain Prinsep in the sites of the new Bridges, and the improvement of the approaches to them, are considered by Government to be judicious, but before distinctly sanctioning the adoption of his propositions, the Governor General in Council desires that he may be required to state in how far they are calculated to increase the expense beyond the original Estimates.

8. The construction of the Flood-Gates and Draw-Bridges upon the plan proposed by Captain Prinsep is approved and authorized.

9. With regard to the proposed measure of filling up the Mahratta Ditch, the Governor General in Council is of opinion, that it is unobjectionable, and may be adopted. It must of course be a great object to clear the ground hereafter to be sold, as well as the space to be retained near the Canal, of the earth which may be excavated from the Canal and Basin. With the same view His Lordship in Council considers it expedient to sanction Captain Prinsep's proposition for making bricks to such an extent as may be practicable—care being of course taken that the manufactory be not carried to an extent which will either detract from the value of the surplus ground, or prove a nuisance to the neighbourhood.

10. The Governor General in Council authorizes the Committee to allow Captain Prinsep to entertain from time to time such Mechanics as he may be able to procure at moderate salaries, and if, as appears from his Report, the Mechanic now entertained by him, be incompetent, he should of course be discharged.

The plans which accompanied your Letter are herewith returned.

I am, &c.

[(Signed) E. MOLONY,]

Deputy Secretary to Government, Territorial Department.

Note.—Of the further papers of this Appendix deemed by the Municipal Committee necessary to be printed, the following (Nos. 51 a, 56, and 59,) have been omitted to be inserted in their fitting place.—J. M.

No. 51. a.

No. 1.

Estimate of Expense required to construct a Dredging Machine, making use of certain machinery now in store, to rest upon two Native Boats strongly bound together, with sleepers and a platform, &c. &c., with two Mud Boats attached.

IRON WORK.	Wt.	Price.
The chain buckets, rollers, and frame for the same are complete, but not put together,		
Required the two hanging blocks for tumbler gudgeons, ...	20 Srs. each,	30 0 0
„ 2 Gudgeons for lower tumbler,	20 Srs. each,	30 0 0
„ A large cog-wheel of 6 feet diameter, fitted to tumbler shaft—Jessop's estimated price, ... ..	... ..	550 0 0
„ 6 Gudgeon steps for 4 in. gudgeons, bolts complete,	20 Srs. each,	90 0 0
„ 16 Gudgeons to two shafts, with winches, ...	10 Srs. each,	120 0 0
„ 2 Shafts bent, each into 4 winches, with 9 inches brass pinions (now in store), fitted to them, ...	at 3 Mds. each,	180 0 0
„ An axle for centre-wheel and pinion, ... ..	... ..	30 0 0
„ 6 Large iron knees with bolts, ... ..	... ..	60 0 0
„ 40 Nut bolts of different sizes,	at 25 per Md.	40 0 0
„ Expenses of fitting up the frame, fixing rollers, chain, &c. &c., ... ..	... ..	180 0 0
BOATS, PLATFORM AND UPRIGHTS.		
Two 500 maunds boats purchase,	at 300 each,	600 0 0
Sleepers, platform, anchors, &c. &c., ... ..	... ..	800 0 0
CONTINGENT.		
Expenses of yard tools, supervision and breakage, {	at 20 per cent. on the whole, }	444 0 0
2 Mud Boats with reservoir and shutters, for emptying mud of Native Craft,	200 Mds. each,	500 0 0
EXTRA CHARGES THAT MAY POSSIBLY BE NECESSARY, although uncertain.		
Agreeable to Mr. Jessop and Mr. May's information, the iron rollers are badly contrived, and should be replaced by wooden rollers, plated with iron, which will cause an extra expense of at least, ... ..	... ..	250 0 0
The buckets likewise are ill-formed for shallow water, and will require some alteration, say costing, ... ..	... ..	200 0 0
The present small cog-wheel and brass pinions appear slight, and may not be fit for the purpose, their replacement by one small iron pinion would cost, ... ..	... ..	200 0 0
Sicca Rupees, ... ..	... ..	4,304 0 0

CALCUTTA :
26th October, 1826.

(Signed) THOS. PRINSEP, Lt. Engineers.

A True Copy,

J. N. JACKSON,

Secretary Canal Committee.

No. 56

No. 98.

To H. T. PRINSEP, ESQ.

Acting Secretary to Government, Territorial Department.

SIR,

I have the honor by desire of the Canal Committee to acknowledge their receipt of your letter No. 1344, under date the 23rd ultimo, and in reply to the concluding Paragraph of it, to forward for submission to Government the copy of a Report received from Lieutenant Prinsep, upon the present state of the Entally Canal, from below the Coolyah Bridge to the Salt Water Lake, the deepening and clearing of which, and the Channel through the Lake, are the primary objects on which he will be engaged during the present season.

2. The Committee beg to recommend to the particular attention of Government the 2nd, 4th, 8th, and 9th Paragraphs of Lieut. Prinsep's Report, from which it will be seen, that little essential benefit can be anticipated from any excavation of that Canal, without an extension of the breadth and an improvement of the Banks, by giving the slope of the latter a greater degree of inclination in order to prevent the injurious effects arising from their actual steepness, thereby preventing the serious injury the Banks are at present liable to.

3. The Committee therefore would beg to submit to Government the expediency of adopting the suggestion offered in the 8th Paragraph of Lieutenant Prinsep's Letter, should the Right Honourable the Vice-President in Council consider it advisable to do so, with reference to the Report of the Collector of Calcutta on the state of that Canal.

4. The land that would be required to effect the object contemplated by Lieut. Prinsep, the Committee apprehend could not be purchased at a lower rate than 100 Rupees per Cottah, which, for the whole extent required for the additional breadth and new roadway, being about (7) seven Biggahs, would amount to Rs. 14,000.

5. The Committee, with reference to the 12th, 13th, and 14th Paragraphs of Lieut. Prinsep's Letter, have instructed him to commence operations in the manner therein proposed, and with a view to avoid delay at this season in advancing the progress of the work, have placed at his disposal the sum of Sa. Rs. (1,000) one Thousand, out of the Balance of Sa. Rs. 3,785, understood to be available in the Treasury of the Collector of the 24-Pergunnahs, pending the orders of Government on the measures requisite to obviate the defects of the existing Balliah Ghat Canal.

6. The preparation of Dredging Machinery for deepening the Channel through the Lake has already been authorized, and is in progress, but the Committee are much disposed to concur in opinion with Lieut. Prinsep, that it would be unadvisable to Bund up that Channel in the manner suggested by the late Major Schalch, as serious injury might accrue, from causing too great a rise in the body of water in the Canal itself, and thereby destroying in a great measure the drainage of the Town.

7. The Estimate in gross called for by you is herewith submitted, from which it will be seen, that an assignment to the amount of Sa. Rs. 2,89,920 will be required to enable the Committee to continue the purchase of the Lands "on that side of the line of communication, so as to continue the Canal progressively Westward."

8. It will, should the Government approve of the suggestions offered by Lieut. Prinsep for deepening and clearing the existing Canal, be requisite, that a further assignment should be made in favor of the Committee for Sa. Rs. 14,000, the sum required to purchase the land mentioned in the 4th Paragraph of this letter, together with the sum of Sa. Rs. 4,903 : 8, being the amount of Lieut. Prinsep's Estimate, making a total of Sa. Rs. 18,903 : 8.

I have the honor to be,

Sir,

CANAL COMMITTEE'S OFFICE,

CALCUTTA :

2nd December, 1826.

Your most obedient Servant,

J. N. JACKSON,

Secretary Canal Committee.

No. 59.

TO CANAL COMMITTEE.

Revenue.

GENTLEMEN,

I am directed to acknowledge the receipt of two letters from your Committee, dated 2nd and 20th instant, on the subject of the expense and nature of the operations to be put in hand this season by the Superintendent of Canals, and likewise stating the value of that portion of the ground required for the Canal which lies between the Salt Water Lake and Maniktulla.

2. With respect first to the Works of the season, the Estimate furnished to the Committee on the 16th instant, and forwarded in the letter last received, assumes a total expense of 42,707 : 8 : 0,* viz. for preparing and working the Dredging Apparatus to be used in the Salt Water Lake, 5,304 0 0†									
For a new cut of 1½ mile from Gabtulla to Dara, 15,000 0 0									
For clearing and bunding preparatory to further excavation from Bay- leygunge to the Chowmooh, 7,500 0 0									
For completing the unfinished cuts from Hooseinabad with the Kul- looar Dam, 10,000 0 0									
And for deepening the Balya Ghaut Canal, 4,903 8 0									

42,707 8 0

3. In addition to the charges here enumerated, the Committee state a further incidental expence that will arise from the necessity of widening the Balya Ghat Canal, for which purpose the requisite ground is assumed by the Committee to cost about 14,000 Rupees; supposing this to be authorized, the total charge of the season would be 56,707-8.

4. But it occurs to the Vice-President in Council that when the land was procured for excavating the last mentioned work, the bare water-way could not have been all that was bargained for and taken by Government. Some space must have been allowed for the bund or road to be thrown up on each side, and this will probably afford a sufficient means of adding to the present breadth of the water-way by narrowing into a foot-path, or eventually by sacrificing altogether one of these roads. His Lordship in Council directs therefore, that before making any bargains for land for widening the Canal, the Committee will ascertain by reference to the Office of the Board of Revenue or that of the Collector of the 24-Pergunnahs, how much land was purchased on that occasion, and whether the space requisite to widen the Canal is not now the property‡ of Government.

5. Putting this item out of the question for the present, the year's operations will cost on the rough estimate about 42,707, which amount His Lordship in Council sanctions to be disbursed, and assignments will be granted to the Committee for the purpose by the proper Officers of Account.

6. In addition to these charges, the outlay requisite to obtain ground for the new cut from the Salt Water Lake to Maniktulla, is estimated by the Committee at 2,89,920, and the expediency of commencing the excavation of the cut as soon as possible, preparatory to opening the communication between the Hooghly and Salt Water Lake, is urged by every consideration having a view to ultimate profit from the undertaking.

7. Under these circumstances, His Lordship in Council, notwithstanding that the period is inconvenient for sanctioning any considerable outlay, thinks nevertheless that

* Erroneously summed up 32,707-8 in the Estimate.

† Of this sum the expense of the Dredging Apparatus Rs. 4304 was sanctioned on the 23rd ultimo.

‡ See Nos. 63, 63 a. 72 b. and Nos. 68 and 69, pages 145-6, Nos. 71½, 72, 72 a. 72 c. pages 147, to page 150 of this Appendix.—J. M.

it would be unadvisable to suspend the purchases altogether. I am accordingly directed to call on you to state your opinion as to the practicability of making your further purchases with a stipulation for payment on the day of final occupation for the purposes of Government, or if it be preferred by the parties, they might receive payment at their option in paper of the last Five per Cent. Loan or in Treasury Notes, bearing five per Cent. payable at the end of two years.

8. In so far as the purchases will have to be made from ryots and others occupying and living on the ground, the first mentioned proposition might to them be most acceptable; but if much of the land has to be procured from wealthy Natives or from Europeans, they would probably prefer to close the bargain at once by taking the paper security proffered.

9. In stating your sentiments on the above proposal, you will of course mention what proportion of the land you reckon to have to procure from each of the above classes.

I have, &c.

The 29th December, 1826.

[(Signed) H. T. PRINSEP.
Acting Secretary to Govt., Territorial Department.]

FINIS.





